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ABSTRACT

The conference paper topics include: business and information technology (IT) education; knowledge management; teaching software applications; development of multimedia teaching materials; technology job skills in demand; IT management for executives; self-directed teams in information systems courses; a team building exercise to software development; World Wide Web-based distance learning; information systems project groups; managing IT for performance; computer technology master plans to meet needs of college students/faculty; site visits as a teaching method in information systems courses; integrating experiential learning and community service in the education of IT professionals; student satisfaction with instructional technologies in management information systems (MIS) classrooms; student perceptions of the Internet; teaching spatial analysis in business; electronic teams and programming; linking MIS with elementary education; implementation of ISO 9000 by regional business; organizational learning; teaching soft operational research in Asia; application of theory of constraints to systems analysis and design; a master's program in information security; the skills audit approach to undergraduate learning; evaluating the changing end-user environment; IT-based instructional strategies; problems faced by innovative IT instructors; object-oriented COBOL and Java; a method for studying electronic marketing strategies; hypermedia aids for advanced learning; and collaborative learning environments for management education. Also included are the IAIM mission statement, description of the paper selection process, a list of reviewers, 1998 IAIM officers and directors, and an author index/directory. (MES)

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13th Annual Conference

International Academy for Information Management
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Helsinki, Finland
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Editor
Camille Rogers

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ACKNOWLEDGMENT

Many individuals not directly involved with the IAIM program have contributed to the continued success and growth of IAIM and the publication of these *Proceedings*. Carol Waller and Sherrye Shatney contributed the most to the *Proceedings* as they completed the bulk of the formatting for the articles found on the following pages. Georgia Southern University's College of Business Administration Dean Carl Gooding and Linda Munilla, director of Publication's and Faculty Research Services, must be thanked for donating the technical and professional support provided by the Publications office staff.

IAIM's Research Committee chair, Betty Kleen, was responsible for the paper review process and the grouping of accepted papers into the sessions that appear on this year's program. Diane Fischer coordinated most of the technical activities needed to put on this year's conference. David Feinstein was very helpful in performing the registration process. We would like to extend a special appreciation to Ephraim McLean and the International Conference on Information Systems organization for their continued support and relationship with IAIM. The conference agency, TSG-Congress Ltd, in conjunction with the Hotel Grand Marina and the Marina Congress Center, should all be thanked for their pleasant, professional, and cooperative working relationship with IAIM during our stay in Helsinki, Finland.

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The International Academy for Information Management (IAIM) is a not-for-profit association founded in 1986 and dedicated to promoting excellence in information management education, practice, and research. The objective of IAIM is to provide a forum in which interdisciplinary researchers and educators in information systems can exchange ideas, techniques, and applications. This objective is realized through various activities and publications.

The Academy sponsors an annual conference in December at which competitively selected papers and panel discussions are presented. A Best Paper Award is announced and all papers presented are published in the *Proceedings*, which are distributed to IAIM members.

A special issue of *The Journal of Education for MIS*, published annually, contains refereed articles addressing excellence in MIS education. The Journal promotes teaching what an information professional needs to know to manage the function effectively—including technical skills, managerial skills & frameworks that make sense out of our chaotic environment.

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December 11-13, 1998

PAPER SELECTION PROCESS

Each year, the process of selecting high quality papers/panels for inclusion in the IAIM annual conference is demanding. Each and every one of the individuals who assisted in the process is owed a debt of thanks. We are sincerely grateful for the time and effort that they devoted to ensure a strong and balanced program covering the major pedagogical issues and concerns of IS educators and trainers, as well as other professionals who incorporate information technology within their disciplines. The fruits of their labors are evident in the papers found on the following pages.

Copies of paper/panel abstracts were submitted to Research Committee Chairman Betty Kleen at Nichols State University. Copies of each abstract were sent to at least three of the reviewers listed on the following page for blind review. Each reviewer critiqued a minimum of three abstracts on the basis of the appropriateness of the topics and the contribution of the approach and results toward strengthening IS pedagogy. Acceptance recommendations were returned to Betty Kleen who was responsible for making the final acceptance decision. Authors of the accepted papers were notified of their acceptance and were sent guidelines for submitting final drafts of the articles to the *Proceedings* editor.

Papers considered "best" are announced at the IAIM Conference. Authors are then asked to revise and submit for review for acceptance to the *Journal of Education for MIS*. Selection of papers for the journal is competitive and rigourous with an acceptance rate of less than 10 percent.

The articles submitted by authors who completed their final drafts by the specified deadline appear in the following pages. The original abstracts submitted for review by authors who were not able to meet the *Proceedings* deadlines also appear in the following pages.

By reading the articles and abstracts that follow, the quality of the work performed by all of the individuals involved in the paper selection process is apparent. We are truly grateful to the members of the Research Committee, the reviewers, and the authors of the papers for contributing to the success of IAIM's 13TH Annual Conference.

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We thank the following reviewers who contributed their valuable time to the International Academy for Information Management:

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The effort of the Officers and Directors of IAIM for 1997-98 should also be acknowledged. The following individuals devoted considerable time, effort, and in some cases made personal financial contributions in order to attend Board meetings and to maintain and enhance IAIM as a professional organization. A considerable amount of program planning and program related decision-making was conducted at the Board meetings.

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TABLE OF CONTENTS

Should the Introductory Information Systems Course Be Removed from the Business School Curriculum? A Preliminary Investigation
Gene M. Gordon and Carl J. Chimi 1

Integrating Business and IT Education
Mohan Tanniru 8

Knowledge Management: A Case Study Approach and Analysis
Jay Liebowitz 17

Tired of Teaching Software Applications?
Susan K. Lippert and Mary J. Granger 22

Development of Multimedia Teaching Materials for a Common Service Subject in Information Technology
Willie Yip 31

Technology Skills in Demand: A Survey of Job Advertisements in New England
Raymond Papp 39

Using Training Ads to Identify High Demand IS/IT Job Skills and Competencies
Thomas L. Case 47

The Creation of Common CIS Foundation Course Sequences for Graduate Entry
Michael V. Doran, Roy J. Daigle, David L. Feinstein, and Herbert E. Longenecker 58

Information Technology Management for Rising Executives: MBA Curriculums at AACSB Accredited Schools
Charlotte S. Stephens and Margaret T. O'Hara 63

Self-Directed Teams in the Introductory Information Systems Course: Lessons Learned
James R. Buffington 76

Using a Team Building Exercise to Enhance the Software Development Process
Susan K. Lippert and Mary J. Granger 83

Web-Based Distance Learning
Arlene O'Leary and Diane Fischer 85

Web-Based Distance Learning: Choosing Effective Technologies for Information Systems Courses
Rajendra Bandi and Kazuo Nakatani 90

The MIS Capstone: Development on an Integrating Group Applied Project Course
James E. Novitzki 100

Making Project Groups Work II: The Impact of Group Process Training on the Performance and Perception of Information Systems Project Teams
Brian Mennecke, John Bradley, and Michael McLeod 110

A Lab-Oriented Approach to Teamwork Projects in Information Systems Courses
Ahmad Ghafarian 122

Managing Information Technology for Performance: Information Systems Education for Executives
Kathy S. Lassila and John D. Borton 126

Designing a Core IT Course for Executive MBA Programs: Objectives, Structure, Delivery, and Lessons
E. F. Peter Newson, Michael Parent, and Scott Schneberger 139

A National Study Assessing Computer Technology Master Plans to Meet Needs of College Students & Faculty
Cindy H. Randall 145

Site Visits as a Teaching Method in Information Systems Courses
Paul B. Cragg 153

The Education of IT Professionals: Integrating Experiential Learning and Community Service
Ruth V. Small, Murali Venkatesh, and Janet Marsden 161

Measuring Student Satisfaction with Instructional Technologies in MIS Classrooms
L. Wayne Shell, Betty A. Kleen, and K. Chris Cox 172

A Preliminary Study of Student Perceptions of the Internet
O. Maxie Burns and Geoffrey N. Dick 176

Teaching Spatial Analysis in Business: The Case of Geographic Information Systems in a Decision Support Systems Course
Brian E. Mennecke 181

Electronic Teams and Programming: The C++ Experience
Dennis Bialaszewski 190

The Need for MIS to Be Linked with Elementary Education
Marsha Bialaszewski and Dennis Bialaszewski 191

Web-Based Teaching: Past, Present, and Future
Dennis Bialaszewski, Janice Burns, Geoffrey N. Dick, Raymond Papp, and Tom Pencek 192

International Quality Standards Systems Implementation of ISO 9000 by Regional Business
Stephanie Huneycutt and Kathryn McCubbin 193

Sava: Committed to Organizational Learning
Marius Janson, Joze Zupancic, Stanislaw Wrycza, and Charles Kuehl 196

Teaching Soft Operational Research in Asia: Mission Impossible?
Judy McKay and Peter Marshall 201

The Application of Theory of Constraints to Systems Analysis and Design
Roy D. Johnson 205

James Madison University Master's Program in Information Security
Karen A. Forcht 208

The Skills Audit Approach to Facilitate Undergraduate Learning
Carl Adams 211

Evaluating the Changing End-User Environment: What Are the New Skill Sets?
Kathleen M. Wright 217

Information Technology-Based Instructional Strategies
Katia Passerini and Mary J. Granger 221

Issues on the Leading Edge: An Examination of Problems Faced by Innovative Instructors of Information Technology
Carl J. Chimi and Gene M. Gordon 230

Migrating COBOL-Based Developers into OO Development Using Examples in OO COBOL and JAVA
Gregory Neal, Alden C. Lorents, and Craig VanLengen 237

A Hierarchy Fuzzy MCDM Method for Studying Electronic Marketing Strategies in the Information Service Industry
Michael T. Tang and Gwo-Hshiung Tzeng 248

Hypermedia Aids for Advanced Learning in Complex and Ill-Structured Knowledge Domains
Alejandro Ramírez and Suzanne Rivard 263

Teaching via the Internet—A Case Study
Geoffrey N. Dick 276

Collaborative Learning Environments for Management Education
Sabine Seufert and Andreas Seufert 279

Author Index 285

SHOULD THE INTRODUCTORY INFORMATION SYSTEMS COURSE BE REMOVED FROM THE BUSINESS SCHOOL CURRICULUM? A PRELIMINARY INVESTIGATION

Gene M. Gordon
Bloomsburg University

Carl J. Chimi
Bloomsburg University

The purpose of this paper is to present a report on the results of a preliminary investigation of the extent to which first-year students entering a university during the summer, who enroll in the summer Introductory Information Systems Course in a College of Business, meet the requirements for the course upon entrance. A second objective is to recommend a course of action to be taken in regard to the continuance or discontinuance of the Introductory Information Systems Course. A justification for the study is that recently, there has been discussion on the possibility of removing the introductory course as a requirement for business students. The argument on the one hand is that more and more students are being exposed to computers and computing in scholastic settings and as a result find the introductory course not only repetitive but also most tedious. In addition, students are acquiring their own computers in rapidly growing numbers and because of their personal use of applications such as Microsoft Office are sufficiently knowledgeable to move on to IS 97. 2[1]. Finally, the need for computer usage in college is vital especially in light of the fact that 45% of college students in the Northeast report they use computers regularly. (Kate)

INTRODUCTION

In approaching the study several questions beg to be addressed:

- Do scholastic computer literacy/competency courses cover IS'97. 1 topics or are they more concerned with the prerequisite for that course, the IS'97 PO which is a "Knowledge Work Software Toolkit?"
- When we say students come to the university with the requisite skills are we talking about the Fundamentals of IS addressed in IS'97?
- Can a paper and pencil test capture skills a student has in using and understanding applications software?
- Is it necessary or appropriate that all College of Business majors take IS'97. 1?

These questions are worthy of in-depth investigation on their own merit but cannot be fully addressed in this study which is limited to that raised in the title. This is just a beginning. As other educators raise questions such as addressed by this study they will need a cache of solid information on which to base their decisions in an intelligent fashion. The authors of this study intend to follow-up on these and other related questions as they may arise in future.

REVIEW OF LITERATURE

There does not appear to be much significant research based upon the concerns of this study. One somewhat related study, conducted in Israel (Koslosky et. al), examined the influence of previous experience on the computer activity of first-year university students. One result observed was that when computer activity was tracked by experience, differences in behavior patterns and magnitude showed some difference. Subjects with low-experience spent more time on computers than high-experience cohorts did. As a result students should be taught according to ability levels. Another study (Bianco) that is most relevant, was designed to answer the question of whether there is still a need for the basic computer literacy course in college. In that study, a questionnaire was sent out to the computer departments of all 501 school districts in the state of Pennsylvania. The purpose of the questionnaire was to find out exactly what computer courses if any were offered at the various schools. In this way, the extent to which students are exposed to computer education in scholastic settings was determined. One result of that study was that students enrolling in the university where the researchers teach, are likely to have "basic computer understandings, knowledge, and hands-on experiences in popular software applications." While the authors of this study would support those findings, they do believe that there is no question but that there may be a significant difference between what is offered in classrooms and what is actually learned and/or carried forward to other learning situations. For example (Seebach) concluded, "about 30 percent of incoming freshmen nationally, are graduating from high school in June and signing up for high-school courses in September". Furthermore, it has been shown that even though students may be given large incentives to use computers over 25% at a university did not take advantage of it in one case study. (Zagorsky)

Still another study (Partee) led the author to suggest that implementing computer-based techniques into the college classroom is hampered because of "inadequate preparation in high schools (caused primarily by limited funding) which leaves many college students computer illiterate". In a study of college students and computers, (Brown/Kester) found that in 1993 "students had studied all sorts of programs in their previous schooling but had forgotten most of them", by the time they arrived in college. In a study of college students and computers Brown and Kester observed that "The computer skills that students learned in high school and early in college did not appear to carry over into their senior year in college". That observation, it must be pointed out, was due to the fact that the students did not use the skills after they learned them. Nevertheless, a study out of Texas Tech University (Geissier/Horridge) concludes "that having taken a high school or university computer class or owning a computer strongly influences a student's self-perceived level of current knowledge about computers and the student's commitment to learning more about them". Catholic University of America has a special program to introduce high school students to science and technology (Chin). Through this program participating schools are provided with computing and networking capabilities. Some 32 States have developed K-12 educational standards and curriculum frameworks for technology (ITEA) which ought to contribute greatly to pre-college computer preparation. Much of the literature fails to address what students know about and are able to do with computers. Even articles on the history of computers in education (Molnar) skip the subject of what and how much students in scholastic settings learn about computers. There is, however, strong evidence that more is being done in the area than ever before. (Plotnick) for example shows that "Computers are pervasive in schools and higher education institutions". Computer literacy is a very popular topic in the literature (Choo) (Smith) (Clements/Carifio) (Amini) as are studies of gender differences as they affect computer learning (Shashaani) and student attitudes about computer use (Larson/Smith). (Geisser/Horridge) (Hannafin/Cole) (Gholamreza/Xenophon).

Some studies (Babcock) call for more articulation between High Schools and Colleges and Universities with an eye towards developing new computer education curricula. As far back as 1993 (Woodhouse) also studied the objectives of introductory computer courses. That study was more concerned, however, with structured programming and programming languages.

One study (Bianco) supported the establishment of a testing mechanism to be administered as a part of the Scholastic Aptitude Test (SAT) or otherwise to determine whether students should be exempted from the introductory college course. The DANTES test currently being normed through the Educational Testing Service (ETS) may be an answer. In this regard also, an instructive solution is the recommendation, mentioned earlier, in (Koslowsky et.al.) that there "...is the need to tailor beginning computer courses to the students' backgrounds".

Perhaps there are also solutions to the problem of what students learn and remember such as possible in the redesigning of introductory computer courses even as suggested by Woodhouse.

RESEARCH DESIGN AND METHODOLOGY

Subjects

The subjects for this study form a unique self-selected group that may be said to have been placed there by accidental assignment. The subjects were incoming fresh-persons more often referred to as 'summer freshmen'. These students are regular admits to the university who have the opportunity to take twelve or fewer credits in the summer and enter the mainstream either in the Fall or the following Spring depending upon summer grade-point average and available seats. The subjects were those who indicated an interest in a major in the College of Business and were enrolled in the course, Introduction to Computer Information Systems. Data were collected on 16 subjects who were present for the first class session. It was expected that there would have been 25 subjects.

Measures

A test instrument, developed in-house, was designed to measure the extent to which the incoming fresh-persons can answer multiple-choice questions on general theoretical computer concepts and applications. The test was prepared from the vendor supplied Test-Bank available with the textbook currently used in the introductory course. Faculty members have examined the test and agree that in large measure it is equivalent to the kind of examination they might give as a comprehensive final examination. The instrument consisted of 100 multiple-choice items from all 13 chapters of the text.[2]

Limitations

As stated above, the subjects for this study were placed by accidental assignment. While this is not the best of design methods the subjects were readily available and it is appropriate for the action research objective of the study. Caution, however, should accompany any attempt to generalize the findings to other populations and such attempts must be made with due regard for the limitations of this study. It is important to note also that the sample studied was small and that the test instrument had not been subjected to tests of validity and/or reliability.

Hypothesis

This study may be considered to be within the class of experiments known as Action Research. In this regard the study is undertaken for an on-the-job application of the results by the investigators and the improvement of the curriculum at a particular institution. The results are by no means less valuable as a starting point for others at similar institutions. The major hypothesis is of the hypothesis-prediction type and is stated as follows:

> Incoming summer fresh-persons who have completed significant computer competency training in a scholastic setting will demonstrate mastery of the content of the College of Business IS introductory course with at least a 70% score as measured by an in-house test deemed suitable for use as a final examination.

The authors' operational definition of significant is at least one school year of experience in a computer literacy/competency course.

Procedures

On the first day of classes for the nine-week summer session students filled out the short questionnaire and answered the questions on the test instrument used as a pre-test. The data collected from these activities were preserved with the use of randomly assigned student identification numbers and the link to actual names destroyed.

Results

Simple percentages were used to show that 12.5% of the subjects reported that they had no computer course in high school. There were 18.75% who had one course, and 68.75% had 2 or more courses in high school. The average score on the test instrument for subjects with no high school courses in computers was 34.00 out of 100. For those with one course the average was 44.00 and for those with 2 or more courses the average was 41.27.

Of those subjects who had computer courses in high school 68.5% covered basic concepts, and 37.5% covered networking topics, while 50% also covered multimedia and 43.75% had studied programming.

Subjects who used one or more word processors were represented at almost 90% while one quarter had used one or more databases. Nearly 40% had used one or more spreadsheet programs.

The subjects reported that 50% had used Windows 3.1 as an operating system and 68.75 had used Windows 95. (See Table 1)

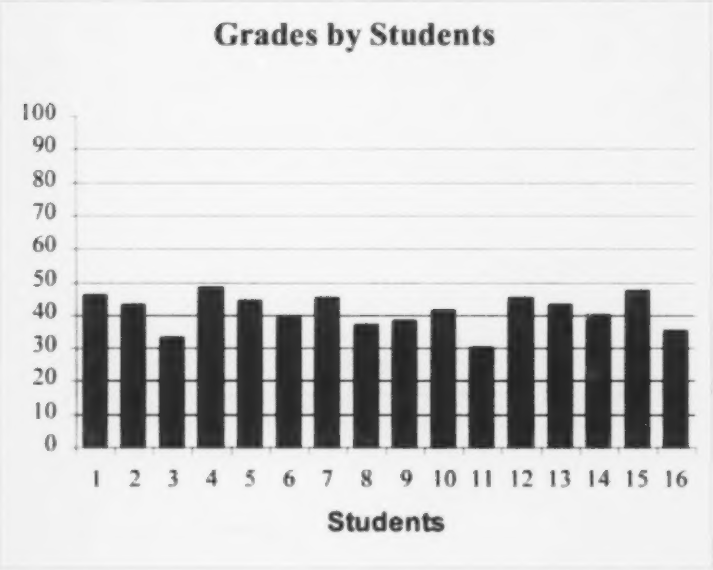
TABLE 1
PRIOR EXPOSURE TO COMPUTER INSTRUCTION

COURSES TAKEN	%	GRADE	TOPICS COVERED	%	SOFTWARE Apps.	%	OPERATING Sys.	%
None	12.5	34.0	Basic Concepts	68.8	Word-Processing	87.5	WINDOWS 95	68.8
One	18.8	44.0	Networks	37.5	Database	25.0	Windows 3.1	50.0
Two or more	68.8	41.3	Multimedia	50.0	Spreadsheet	37.5	Other	0.0
			Programming	43.8				

The mean score on the pre-test was 40.9% with a range from 30 to 48. (See TABLE 2) So that none of the subjects scored at or above the 70% level expected by hypothesis. The hypothesis then is rejected.

FIGURE 1
INDIVIDUAL GRADE RESULTS ON PRE-TEST

GRADE
46
43
33
48
44
39
45
37
38
41
30
45
43
40
47
35



An interesting result is contained in an analysis of the grades students received on the pre-test based on chapters from the text. (See Figure 2) The 70% level was achieved on chapter 7 which covered Word-processing and Desktop Publishing while concerning chapter 8 (Spreadsheet and Database Applications) and chapter 9 (Communications-The Electronic Web), the score was slightly above 60%. The rest of the 13 chapters all falling at or below 50% show that there is a need in the areas of Hardware, Software, Programming etc.

FIGURE 2
GRADE RESULTS ON PRE-TEST BY CHAPTER

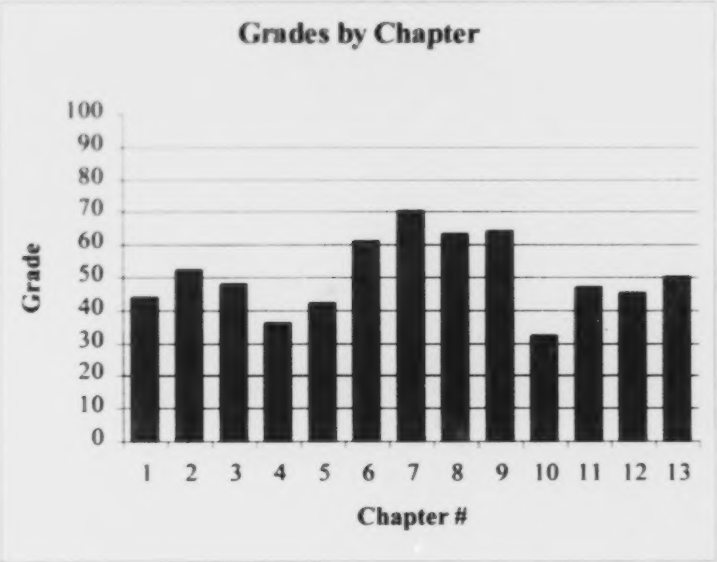


TABLE 2
SUMMARY OF GRADES AND QUESTION DIFFICULTY

	Easy	Medium	Hard
Student	*20*	*54*	*26*
1	75.00%	40.74%	34.62%
2	45.00%	44.44%	38.46%
3	50.00%	25.93%	34.62%
4	65.00%	42.59%	46.15%
5	60.00%	40.74%	38.46%
6	45.00%	35.19%	42.31%
7	80.00%	38.89%	30.77%
8	40.00%	42.59%	23.08%
9	45.00%	33.33%	42.31%
10	65.00%	35.19%	34.62%
11	60.00%	20.37%	26.92%
12	65.00%	42.59%	34.62%
13	70.00%	37.04%	34.62%
14	55.00%	35.19%	38.46%
15	60.00%	50.00%	30.77%
16	55.00%	27.78%	34.62%

TABLE 3
SUMMARY STATISTICS

Total grade	
Mean	40.875
Standard Error	1.306633716
Median	42
Mode	43
Standard Deviation	5.226534862
Sample Variance	27.31666667
Kurtosis	-0.408085553
Skewness	-0.613867968
Range	18
Minimum	30
Maximum	48
Sum	654
Count	16

Concerning the difficulty of test questions, as may be expected, subjects did a lot better on question deemed easy than they did on those of medium difficulty and in turn, better on the medium than on the hard. For student 3 both the easy and hard questions were answered at a higher level than the medium. A similar result was se4en also for students 4, 9, 11, 14, and 16.

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CONCLUSIONS AND RECOMMENDATIONS

Based upon the rejection of the hypothesis, the authors conclude that until further research is done the Introductory Computer Information Systems Course should remain a required part of the Business College curriculum. A carefully constructed test of the computer abilities of high school students needs to be established, as the instrument used in this study did not provide a high degree of confidence. Prior to the development of the test some understanding must be reached among high school, college, and university computer educators as to what students should know or be able to accomplish with computers. Then the textbook publishers, curriculum specialists, test bank designers and others must work together to ensure outcomes that allow the high school graduate to have full computer competency. The literature shows that there is movement towards both of these criteria and especially in regard to the latter on the state level. Based on this study, students appear to be getting exposed to application suites such as Microsoft Office. Whether that is sufficient for computer literacy or competency remains to be seen and begs for investigation, The authors can remember when there was a burst of enthusiasm in educational circles for abolishment of freshman English and algebra from the college curriculum since so much is offered in the fundamentals of those subjects at the scholastic level. This idea has not been borne out in reality and it is suspected that the same will be true of freshman computer courses.

It is recommended that this study be replicated in a number of different settings with standardized test instruments and topic commensurate with what is taught in schools. The questions raised at the front-end of this report remain compelling and should be addressed. Perhaps a team such as that which designed the IS'97 model curriculum should be assembled to bridge the curriculum gap between high school and college establish a pre-college model curriculum,

ENDNOTES

1. IS '97 is the Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. This curriculum was developed as a collaborative efort of the Association for Computing Machinery, the Association for Information Systems, and the Assoication of Information Technology Professionals. The course IS '97. 1 refers to the first course in the sequence of courses under this model curriculum.
2. Curtin, C., et al., Information Techology: The Breaking Wave. McGraw-Hill, 1998.

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INTEGRATING BUSINESS AND IT EDUCATION

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INTRODUCTION

In today's changing business and IT world, it is critical that we educate students to be adaptive to the changes in the market place, use information technology effectively when appropriate, and work effectively as teams to solve business problems. Many models have been used in business and computer science schools to provide students with either the technology or application focus, and these are successful in building needed "mediation" skills - provide business student with some IS exposure/ understanding or CS student with business exposure/relevance.

However, as the growth in demand for the use of technology increases in the business arena, it is critical that non-technical users become more proactive in using IT and managing the development of IT projects. This would have required extensive training in the past when most of IT is main-frame based and application development is based on 3rd generation software. However, in today's PC/workstation environment and GUI-based application development, it is not inconceivable that many work-flow automation, data retrieval, web-based applications can be conceived, developed and managed by users that are technically inclined. This shifting of responsibility for some of the application development (ex: personal productivity type applications) to users, empowers them to use technology more proactively. It also relieves the IT units from the development of such business driven and highly volatile systems, so they can focus on enterprise-wide systems and act as an effective R&D for the firm by exploring the relevance of new and continually changing technologies.

With this in mind, the School of Business Administration at Oakland University has established a business minor in applied technology (called Applied Technology in Business) and it is available to all business students on a competitive basis.

This minor is different from a typical IS minor (or major) in the following way: an IS minor often is a collection of courses a business student takes from the IS department to get exposure to systems development activities, so they appreciate the complexities behind systems development/implementation effort. In other words, the focus of these IS minors is to make the business student see the world through the eyes of an IS professional. This is probably sufficient if a user is going to continue to rely on IS professionals to build systems. However, if we want to make users more proactive in the development and use of IT on their own, they need to see IT from a business professional's perspective: what are the business problems a firm is facing and how can IT play a role in solving these problems. Also, in order to gain confidence in their own capabilities and become proactive in the use of IT, they need to build application prototypes using IT and solve specific business problems. In other words, *they need to see IT from a business professional's perspective*.

The rest of this paper is organized as follows. Next section briefly describes the program and it current participants. Section three provides a broader program overview and discusses two specific sections that have a direct impact on the program curriculum.

APPLIED TECHNOLOGY IN BUSINESS (ATIB) PROGRAM

The *Applied Technology in Business* program is a unique business minor that focuses on training business students in the proactive use of information technologies to solve business problems. It has the following features:

- **Program is sponsored by corporations** - every student admitted into the program has a corporate sponsor, who makes a contribution to the program for two years
- **Sponsoring companies provide real business problems for the students to solve**, and these are

addressed in *three of the four courses* they take under this program

- **Students, drawn from all business majors**, learn problem solving, application development, project management and IT skills from the classroom, and apply these skills concurrently to solve business problems that are posed by the sponsoring firms

- **Students work in teams to solve business problems over a three semester time period**, so they learn the application of IT to a variety of business settings and manage the development of these applications projects

- **Students incorporate many of the business and IT professional skills within their project activities**. Some of these skills include:

- Making oral presentations,

- Preparing executive summaries and status reports,

- Working in teams, managing time and resolving conflicts,

- Tracking projects and allocating resource (time and human resource)

- Documenting and prototyping,

- Gathering data and analyzing it, and

- Learning to use help systems and other support environments in learning technology, etc.

- **Students admitted into the program are undergraduate juniors**

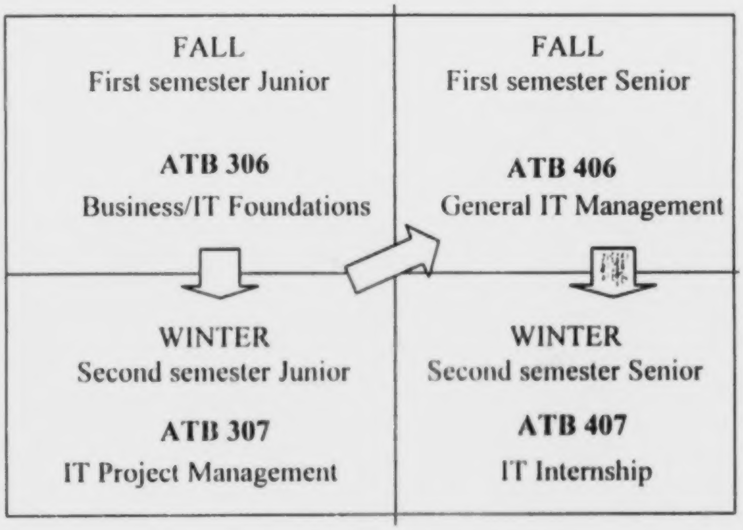
- **Students will have taken two IS courses**: PC Introduction and Introduction to MIS concepts

- **Students have four semesters to complete the program** and their last semester will be a half-time, in-residence internship at a corporate site, and

- **Students are to become educated in the broader management and use of information technology**

Course Structure

Four courses are established to support this program (ATB 306, ATB 307, ATB 406 and ATB 407).



FALL
First semester Junior

ATB 306
Business/IT Foundations

FALL
First semester Senior

ATB 406
General IT Management

WINTER
Second semester Junior

ATB 307
IT Project Management

WINTER
Second semester Senior

ATB 407
IT Internship

The students enter the program during the first semester of their junior year and leave the program in the second semester of their senior year.

1997-1999 Corporate Sponsors

Champion Enterprises
Comerica
Durakon Industries
EDS (2 students)
IBM
Kelly Services
Meritor Automotive
Chrysler Corporation
Compuware
Eaton Lectron Products
Hubert Distributors
ITT Automotive
Lear Corporation
MSX International
Core Industries (now The United Dominian Industries)
School of Business Administration (2 students)

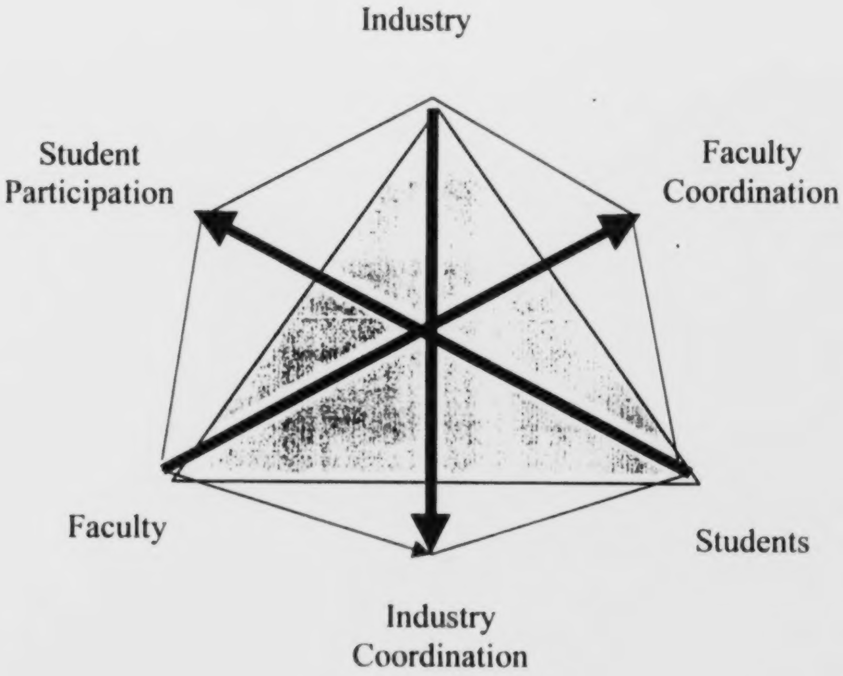
1998-2000 Corporate Sponsors

Champion Enterprises
Compuware
EDS (2 students)
Chrysler Corporation
Eaton Products
GMAC
ITT Automotive
Lear Corporation
National Tech Team
RGIS Inventory Specialists
St John's Health System
Kmart
Meritor Automotive
Providence Hospital
St Joseph Mercy Hospital
Volkswagen of America

PROGRAM FRAMEWORK

The objective of the Applied Technology in Business (ATiB) Program is to coordinate education, training, knowledge transfer and research in the *application of information technology to business* using the coordinated effort of three entities: *faculty, students and professionals from industry.* Refer to Figure 1. While this by itself is not new as many schools use internships and co-ops to support student-industry interaction, consulting to support industry-faculty interaction and traditional class-room teaching to support faculty student interaction, what makes this program unique is the active participation of the all three in each activity. This is elaborated below.

FIGURE 1
A TIRADIC PARTNERSHIP OF FACULTY, STUDENTS, AND INDUSTRY



The ***faculty<->student*** interaction in this *triadic relationship* uses a variety of pedagogical means to support the class room teaching and ***industry*** plays an active role in this process. They

- listen to student presentations at monthly workshops and provide feedback,
- provide and coordinate projects so the students can learn about the application of technology,
- grade some of these project outcomes and the associated project activities,
- come to the class room to discuss various issued industry is facing in the information technology arena, and
- participate in the yearly review of the program (curriculum, technology and research).

The ***student<-> industry*** interaction allows the firms to explore new technologies using bright and young minds in a relatively low-risk environment, while at the same time providing opportunities for the students to experience the complexity of problem solving in the real world. While this type of interaction in seen in many co-op and internship programs, this program differs from others in the following ways

- The project activity is modularized over three semesters, so that both business and IT skills are learnt incrementally. The ***faculty*** play an active role in this interaction by coordinating projects more directly in the early phases of the program and gradually letting the students manage them on their own towards the end.
- Even if a student is working on one project, because most of these are done in the early phases in the ATiB laboratory, they get to learn from other student projects and share what they learnt with others. The ***faculty*** play an important role in supporting this knowledge sharing.
- Each student works with as many as three to four companies on multiple projects with different students so they get a breadth of exposure to real-world problems and the associated IT-related challenges, and learn to work with a variety of students. Again, ***faculty*** play an important role in the project assignment and team-formation.

The ***industry<->faculty*** relationship allows for the continued faculty learning of the problems in the application of technology to business, so appropriate research ideas can be pursued. Again, while this in itself in not uncommon and many consulting activities of faculty support this type of exploration, what makes this program unique is the role ***students*** play in the initial research exploration. The diversity of projects students engage in allows the faculty to look at the exploration and use of technology first, and then look for methodologies and generalizations based on this experience. Also, given that the projects are not limited to any particular area (address all aspects of value chain and all types of technologies), the research endeavors allow the participation of faculty from multiple disciplines and multiple universities.

This partnership is operationalized using four basic frameworks

Business Application Framework
Skill Training Framework
Knowledge Management Framework
Applied Research Framework

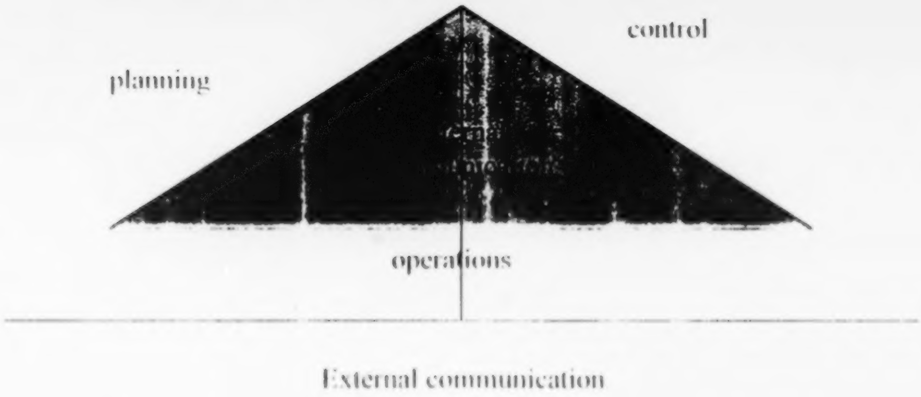
In this section, we will discuss the business application and skill training frameworks, as these are critical for the curriculum development of the ATiB program.

Business Application Framework

Given that use and/or exploration of information technologies by different organizations at any given time is to support some aspects of business operations or decisions, we wanted to use a generic framework to map the corporate projects that are undertaken under this program. This not only makes the teaching of concepts easier, but it also helps us look for similarities among various projects, generate methodologies that are applicable across applications, and store and reuse knowledge acquired.

The framework we chose is shown in Figure 2. The operations activity is studied further in depth by mapping it to various primary value chain activities (Porter). The control and planning activities are expanded to accommodate the multiple levels of decision making (operational to strategic), and the communication is looked at from internal and external perspectives.

FIGURE 2
BUSINESS APPLICATION FRAMEWORK



Each of the projects is mapped to operations, control, planning and communication (internal and external) activities of a firm. An incremental and evolutionary approach is used to discuss the applications. Study the simple and baseline applications first and build on these to more interesting and somewhat complex applications in each of the other two semesters. See Figure 3.

- First semester includes process analysis/design of business *operations*, simple data analysis for *control* and spreadsheet modeling for *planning*, and simple email/web based support for *communication*;
- Second semester includes inter-organizational linkage of business *operations*, advanced information retrieval for *control*, knowledge based and group decision support systems for *planning*, group-ware based interaction for *internal communication*, and web-based integration for *external communication*;
- Third semester includes network-related issues for integration of *operations*, environmental scanning for *control*, strategic uses of IT and resource allocation as part of *planning*, and intranet and Internet technologies for *internal and external communication*.

FIGURE 3
IT USE IN SUPPORT OF BUSINESS APPLICATIONS

	ATB 306	**ATB 307**	**ATB 406**
External Communication	Email and Internet/Web Use	Web/data base interfaces, Internet-based research	Networked and virtual organizations
Internal Communication	Email and Intranet use, document transfer, file attachments	Work-flow and document management	Knowledge management and reuse
Planning	Decision support for business functions, what-if analysis	Knowledge-based and group decision support	IS planning and resource allocation
Control	Reporting and querying of data from data bases	Data analysis, problem diagnosis, and environmental scanning	Executive support and competitive intelligence
Operations	Business process documentation and redesign	Process sequencing, costing, and use of IT for process improvement	Role of networks on inter-organizational operations

Skill Training Framework

A set of business and IT skills a business student needs to acquire are identified from prior research. In order to assess the relative importance of these skills for a business student, who is to become effective and proactive in the use IT to solve business problems, we surveyed several academic faculty and corporate sponsors of this program. These skills in the order of importance are shown in **Figure 5.** We recognize the need to revisit this set frequently if the program is to remain relevant over time.

In order to incorporate the training of business students in these skills over a three semester program, an **incremental approach** is used (see Figure 4).

1) *Introduce the students to high priority business and IT skills in the first term and add others incrementally.* **Figures 6 and 7** show the skill ladder for both business and IT skills.

2) *Integrate the learning of these skills into the classroom teaching (applications using the business framework discussed earlier) and projects provided by the sponsors.*

This is accomplished by having classroom work on building various IT applications (e.g. enterprise data modeling, group decision support system for budgeting, work-flow automation, e-commerce applications, knowledge based applications, etc.) completed in teams and presented (oral as well as written) to various corporate sponsors.

FIGURE 4
BUSINESS/SKILL INTEGRATION

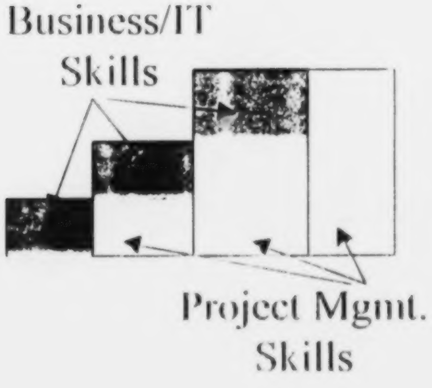


FIGURE 5
A LIST OF BUSINESS AND IT SKILLS

Skills Ranked 7-8 on a 1-10 scale (10 being the most important)

Business skills
Problem solving skills
Working in teams and supporting diverse views
Oral presentations of project proposals and summaries
IT skills
    Dos/Windows, Data bases, Spreadsheet, Internet/Web use, and Word processing

Skills ranked 6

Business skills
    Written communication skills
    Research skills
    Project management skills
    Conflict management
    Managing Team work
IT skills
    Generating reports
    Use of different software packages
    End-user application development
    Cost justification and System integration

Skills ranked 4-5

Business skills
    Interviewing
    Professional correspondence
    Meeting management
    Entrepreneurship
    Innovation
    Broader business issue understanding
IT skills
    Access to external data
    Some programming (e.g. Vbasic)
    Data analysis
    Use and evaluation of software packages
    Network management
    IT management - planning and implementation
        Ethics and security issues

FIGURE 6
BUSINESS SKILL LADDER

ATB406
Interviewing
Professional correspondence
Meeting management
Enterpreneurship
Innovation

ATB307
Written communication skills
Research skills
Project management skills
Conflict management
Managing team work

ATB306
Problem solving
Working as a team and accepting diverse views
Oral presentation

FIGURE 7
IT SKILL LADDER

ATB406
Access to external data
Vbasic-type programming
Data analysis
Use/Evaluation of packages
Network management

ATB307
Generating reports
Use of different software packages
End-user application development
Cost justification
System integration

ATB306
Dos/Windows
Data bases
Spreadsheets
Word processing
Electronic mail/Internet access

FIGURE 8
A DESCRIPTION OF PROJECTS COORDINATED IN WINTER 98

Project Number	Brief Description	Project Category	IT Category
1	Do market research for a technology-based employee placement firm	Business Analysis	- none -
2	Do an analysis of the current business processes used to support an external customer and propose a feasible IT based architecture	Process Analysis	disparate IT
3	Analyze current system and develop a streamlined approach to extracting pricing data	Systems Analysis	Lotus Excel
4	Analyze current work-flow model implemented in a groupware product and re-use this model for other applications	Systems A & D	Lotus Notes
5	Implement organizational policies/procedures system for use by multiple users	Design	Lotus Notes
6	Analyze current data gathering process used to allocate human resources and streamline it for greater efficiency and reporting	Analysis & Design	Access Web VBasic
7	Investigate ways to support user innovation by enabling them to seek the needed information	Business Analysis	- none -
8	Analyze current workstation monitoring system, used to identify application inventory, and redesigned it for improved access and querying flexibility	Systems A & D	LanDesk database
9	Validate a new system being designed to replace an existing sales, invoicing and operations system	System Validation	Contract Software
10	Investigate into the feasibility of developing a "Competitive Intelligence System"	Business Analysis	Internet
11	Investigate into the way one can support distributed learning using Internet/group-ware products	Systems Analysis	LOTUS Notes
12	Analyze systems used to support "business recovery" and Year 2000 validation	Systems Analysis	- none -
13	Investigate into the use "help system software" for tracking customer complaint processing	Analysis & Design	Help Systems
14	Develop an integrated web application that links corporate and departmental views (SBA and departments)	Analysis & Design	Web
15	Develop a system that supports analysis of human resource data, stored in a data warehouse	Analysis & Design	Access/ Vbasic
16	Migrate from a current system to a new system to better support query and report generation	A, D, and Implement	Access

3) *Use corporate projects to support incremental learning of many project management and problem solving skills. A sample of our first term projects (winter 1998) are shown in Figure 8.*

- The first semester is spent in learning problem solving skills, engaging in team-work, etc. using class projects, without direct industry interaction. *Percentage of coursework allocated to corporate projects = 0%*

- The second semester is spent in solving real industry problems using a campus laboratory under closer supervision of the ATiB staff. *Percentage of coursework allocated to corporate projects = 40%*

- The third semester is spent solving business problems with less direct supervision and greater mix of lab and company facilities. *Percentage of coursework allocated to corporate projects = 70%*

- The last semester is spent doing all the work at the company site as a half-time resident intern. *Percentage of coursework allocated to corporate projects = 100%*

4) *Integrate individual learning of a student team from these projects with the learning of all others and support diverse exposure to problems/projects that address multiple facets of a business.*

Each student team of two students is assigned to two different company projects each semester. This exposes the students to a minimum of five different company projects during the program. To facilitate sharing of individual project knowledge with all others, the students use the lab environment to complete projects for two terms, thus allowing broader exposure, present their work periodically to the entire class for feedback and evaluation.

5) *Relate the project work to business application framework.*

Each of these projects are mapped to applications in operations, control, monitoring, and communication and the project summaries are stored under these categories for future use.

CONCLUSIONS

In this paper, we discussed a framework that is being developed to train business students in the proactive use and management of information technology and discusses how this activity is supported through projects provided by several corporations. This program is relatively new (one year old) and will undergo several revisions and refinements before it can be considered a success or used as a template for other schools to follow, if appropriate. However, our intent at this time is let people know about the program so we can get constructive feedback from our sponsors, potential sponsors, faculty from various schools, etc. and of course from students, who are primarily the recipients of such a program. Hope to keep you informed of our progress and you can continue to monitor our activities via our web page: www.sba.oakland.edu/atib/.

KNOWLEDGE MANAGEMENT: A CASE STUDY APPROACH AND ANALYSIS

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Knowledge management is one of the fastest, emerging trends in industry and government. Knowledge management deals with how best to leverage knowledge within and external to the organization. Because this knowledge management field is just developing, there is tremendous work needed to build knowledge management foundations, concepts, methodologies, tools, and techniques. Those organizations that aren't exploring knowledge management within their organization will fall behind their competitors. This paper addresses a case study of an organization that recently was assessed and analyzed, by the author, for its knowledge management activities. Knowledge management is such an important topic that Information Systems (IS) curricula should include a course on this timely and emerging topic.

INTRODUCTION

Ask almost any Chief Executive Officer what separates their company from their competitors. The typical response is "our knowledge." Many leading organizations are now discovering that they need to do a better job of capturing, distributing, sharing, preserving, securing, and valuing this precious knowledge in order to stay ahead, or at least survive, with their competition. Companies like Coca Cola, Sequent, Hewlett Packard, Coopers and Lybrand, and others have established new positions within their companies to oversee and better manage knowledge in their organizations. This new position is often called the "Chief Knowledge Officer", and Knowledge Analysts (like at FedEx) assist the CKO in analyzing the knowledge processes within the firm in order to improve human performance.

The process of managing knowledge in organizations is referred to as "Knowledge Management" or "Enterprise Knowledge Management" (Liebowitz and Wilcox, 1997; Liebowitz, in press). Knowledge management is the process of creating value from an organization's intangible assets. The focus is to provide mechanisms for building the institutional memory or "knowledge base" of the firm to better apply, share, and manage knowledge across various components in the company.

Some companies are now being called "knowledge organizations" (Liebowitz and Beckman, 1998), as we have moved beyond managing "information" to managing "wisdom." Wisdom might be equated with information plus added value. The added value might be some rules of thumb or "heuristics" acquired from years of experience. Wisdom is the application of "knowledge" in the right settings. Without such knowledge or wisdom, companies might falter into Social Darwinism where the weaker firms get eliminated. In order to best leverage knowledge or wisdom in the organization, companies are transforming into "intelligent organizations". With reengineering, downsizing, rightsizing, and other "ing's" in vogue, companies are looking toward maximizing their knowledge in organizations in creative and intelligent ways.

Organizations need to get on the information and knowledge superhighway in order to stay competitive (APQC, 1998). Direct marketing and improved distribution channels can be facilitated by the Internet to better target and serve customers. Additionally, many organizations are using intranets to build a knowledge repository (Liebowitz, 1997; 1999) within their organization for improved sharing of knowledge and information.

This paper describes a case study examining the knowledge management activities of a leading US military organization specializing in strategic leadership. This organization has about 120 employees of which 50 can be considered knowledge workers. It is argued that knowledge management is such an important topic that Information Systems (IS) curricula must include a course in this area.

STRATEGY, APPROACHES, AND PROCESSES

Based upon the survey results, the organization under study does not know how to measure the value of its intellectual capital. People, processes, and products/services are the most important knowledge carriers in its organization. The organization's overall strategic goals do not include knowledge management explicitly. A knowledge management initiative has been conducted for less than one year. Customer intimacy (focusing on providing "total" solutions for a well-selected group of customers) is currently the strategic emphasis within the organization. The most important knowledge management objectives in the context of the organization's business strategy are combination of customer-knowledge and internal know-how. The least important knowledge management objectives are: acquisition of new knowledge from external sources, generation of new knowledge inside the organization, standardization of existing knowledge in the form of procedures/protocols, transforming individual (people's) knowledge into collective knowledge, and facilitation of the "re-use" and consolidation of knowledge about operations.

Intranets (including groupware) is the major approach used in the organization for sharing and combination of knowledge. Lessons learned analysis is the key approach used for the creation and refinement of knowledge. Lessons learned inventories are used for the storing of knowledge in the organization. Each of these approaches is used at a business unit-specific level versus an organizational-wide level.

About a year ago, the key knowledge management-related activity in the organization was established to have a lessons learned section in the organization's intranet. The focus is to share lessons learned with new employees and organizations. It is unclear as to what the bottom-line impacts of this practice area are at this point.

A second example of a knowledge management-related activity used in the organization is an intranet repository of information for organization exercises. The senior leaders of the organization started this project about two years ago and is an integral part of the organization's exercises. It has resulted in improved sharing of information and archiving of information and knowledge.

CULTURE

The decentralized operations of the organizational culture seem to support effective knowledge management. A lack of teamwork among sub-elements of the organization appear to be barriers to effective knowledge management in this organization. There has been little to no organizational buy-in and acceptance about knowledge management at the senior, middle, and supervisory management levels. There has been much buy-in and acceptance at the professional/knowledge worker staff levels. Currently, there are no specific training programs in place to support knowledge management. No incentives or reward system is in place to support knowledge management.

TECHNOLOGY

Information technology (IT) is used as an enabler in the organization to learn and innovate to do the job better, and to create new products and services. There is no "formal" WebMaster function. Intranet technology is used to support knowledge management efforts via shared documents/products, and gathering and publication of lessons learned/best practices. Internet functions are also used for knowledge exchange with suppliers and customers. Knowledge-based systems and centralized best practice/lessons learned databases are used in the organization as well for supporting knowledge management functions. More expert systems are being planned to support knowledge management, especially the use of intelligent agent technology over the intranet.

BUSINESS OUTCOMES

The organization currently does not capture, measure, and track the value of the organization's knowledge. It doesn't measure/track the (new) knowledge generation within the organization. Knowledge sharing is also not measured within the organization. No measurement system is in place that shows how knowledge management affects the bottom line. No measurement is made of the value added and cost of knowledge management in the organization. The desired business benefits for the organization through the systematic management of knowledge and intellectual capital are: improving (quality) products and services, innovation (new products and services), and improved (strategic/tactical) decision making.

Increased innovation in the organization is measured by mainly anecdotal evidence and evaluations/surveys. Business growth is measured by evaluations/surveys, and practice and process improvement is measured by anecdotal evidence in the organization. Increased customer satisfaction is measured by evaluations/surveys, and enhanced employee capability and organizational learning are measured by anecdotal evidence. Knowledge management isn't currently integrated with business processes or product processes in the organization.

Knowledge Survey of Valuating Human Capital in the Organization under Study

A knowledge survey dealing with human capital was completed in order to determine how the organization contributes to each factor below:

Training and Education

- Formal training of employees: one week orientation to senior employees; usually 1 week every three years to other staff.
- Formal education of employees (i.e., degrees): senior employees have usually Masters degrees and many have Ph.Ds; most of the senior employees have been through senior service college; the other staff have mostly a high school education.
- Mentoring and On-the-Job Training: it does happen but is not formalized.

Skills

- Research skills: for senior employees, it's a definite plus.
- Entre- and Intra- preneurship skills: minimal.
- Retention rates of employees: senior employees-high; other staff-fair.

Outside Pressures and Environmental Impacts

- Industry competition: for senior employees, not much competition; information systems/computer science-related employees--highly competitive; other staff--very little competition.
- Half-life of information in industry: senior employees--strategy, yearly; information systems staff--6 months; other staff--2 years.
- Demand and supply of those in the field: senior employees--demand low, supply medium; information systems staff--demand high, supply medium; other staff--demand low, supply high.

Internal and Organizational Culture

- R&D expenditures of the organization: very small in comparison to operations expenditures
- Formalized knowledge transfer systems (e.g., lessons learned databases or best practices guidelines institutionalized within the organization): lessons learned section of the organization's intranet.
- Informal knowledge transfer systems (e.g., speaking with top management, secretaries and assistant to top management, attending organizational events, the "grapevine"): very informal, dependent on individual initiative.
- Interaction with customers and users: highly structured for selected individuals to perform most interactions with customers.
- Physical environment and ambiance (e.g., nice office, reasonable resources, etc.): great office, computers, and resources for performing jobs.
- Internal environment within the organization (e.g., reasonableness of demands by management placed on the employees, etc.): very reasonable.
- Short term (2-4 years) and long term (5 years or more) goals/prospects, from the employee's perspective, of the organization's viability and growth: organization's very short term goals (1 year) are known; no knowledge of short term or long term goals for the organization; assume current mission and goals will be the future goals.

Psychological Impacts

- Morale (attitude, benefits, compensation, conferences, travel, vacation time, etc.) of employees: senior employees--good; information systems staff--poor; other staff--average.
- Creativity and ingenuity of employees--good.
- Employee stimulation and motivation--good.

Ranking of Factors from 1 (most important) to 19 (least important) in terms of their importance towards contributing to human capital growth in the organization:

For the top 5 factors, rate how well (Excellent, Good, Fair, Poor) the organization is satisfying them:

1--employee morale	FAIR
2--employee stimulation and motivation	GOOD
3--short term and long term goals	FAIR
4--formalized knowledge transfer systems	POOR
5--informal knowledge transfer systems	FAIR
6--employee creativity and ingenuity	
7--formal education of employees	
8--formal training of employees	
9--mentoring and on-the-job training	
10--retention rates	
11--entre- and intra- preneurship skills	
12-- internal environment within the organization	
13-- physical environment and ambiance	
14-- research skills	
15-- R&D expenditures of the organization	
16-- interaction with customers and users	
17-- demand and supply of those in the field	
18-- industry competition	
19-- half-life of information in industry	

ANALYZING THIS ORGANIZATION FROM A KNOWLEDGE MANAGEMENT PERSPECTIVE

In analyzing this organization from the Delphi survey results, this organization is implementing some knowledge management activities (such as a lessons learned section on their organization wide intranet), but little has been done. Even with this lessons learned repository, there is a "knowledge attic" approach being used whereby a passive data collection and a passive analysis and dissemination are used. The knowledge attic approach is the simplest of the techniques for developing a knowledge repository where the lessons learned, in this case, are entered by the individual workers in the organization and are accessed if people in the organization want to see some of these lessons learned. There isn't an internal "knowledge transfer department" within the organization that is checking if a "lesson learned" is truly a lesson learned (i.e., meeting certain criteria and guidelines), and this department isn't playing an active role in analyzing these lessons learned and sending them to appropriate individuals in the organization. Interestingly enough, a different arm of this global military organization (not the specific organization being studied here) has a "knowledge publishing" approach to building their lessons learned knowledge repository. In this other part of the organization, there is a Center for Lessons Learned which allows electronic submission, via the web, of lessons learned to this Center. Correspondingly, once these lessons are received, they are checked for appropriateness as a lesson learned, and then are sent by the Center to individuals in the organization who would find these lessons to be of value.

The organization being studied here doesn't seem to value its knowledge based upon senior level support. Very few formalized knowledge transfer systems have been developed within the organization. Strategic goals and objectives are not easily conveyed from senior management to those in the organization. Very little training and education is provided to employees in the organization to further develop their skills and expertise. Very little is being spent in research and development to expand the knowledge base in the organization. There is also little concern for valuating knowledge in the organization in order to measure its value added being provided to the organization. Knowledge is typically transferred via word of mouth, internal memos, and through the grapevine.

From an organizational climate and culture viewpoint, knowledge management would enhance the activities that are stressed by the organization: namely, various strategic exercises that are performed throughout the year in terms of wargaming and simulations. Sharing lessons learned and best practices from one year's exercise to the following year's exercise would greatly benefit and improve the exercises from one year to the next. This is being accomplished a bit, but more threaded discussions, on-line forums, and categorized lessons learned could greatly add to this experiential base. Additionally, a formalized knowledge transfer system could be developed in order to better convey the strategic, short term, and long term goals of the organization from senior leadership to others in the organization, and to provide input from the various organizational members towards creating these goals and objectives.

The top five factors cited in terms of importance towards contributing to human capital growth in the organization were, in order: employee morale, employee stimulation and motivation, short term and long term goals, formalized knowledge transfer systems, and informal knowledge transfer systems. It appears that only employee stimulation and motivation is rated as "good" in terms of how well the organization is satisfying their objectives. The other factors were rated as either "fair" or "poor" in terms of contributing to human capital growth in the organization. A slight paradox is occurring in the organization whereby employee stimulation and motivation is deemed higher than employee morale. One would think that the two factors would correlate well, but this may not be the case with this organization. This would have to be further investigated.

SUMMARY

This organization certainly is not a "knowledge organization", due to its lack of knowledge management activities and processes throughout the firm. In fact, a recent survey indicated that out of 200 Fortune 500 companies, only 4 of them thought of themselves as a "knowledge organization." A knowledge organization is an entity that leverages and maximizes its use of knowledge in a value-added way, internally and externally, to the organization.

In order for organizations to become better cognizant of the methodologies, techniques, tools, and concepts involved with knowledge management, universities should offer courses on knowledge management to help shape the field. Specifically, information systems (IS) curricula should include a course dealing with "knowledge management". Most universities currently lack such a course, with the exception of such schools as University of Texas-Austin and George Washington University. In the future, as the knowledge-based economy continues to grow, knowledge management will become an integral part of the strategic mission of organizations.

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TIRED OF TEACHING SOFTWARE APPLICATIONS?

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Instructor-lead instruction is not the only way to learn software application packages (Harp, Satzinger, Taylor 1997). Many university business schools have an instructor-led course introducing computer software application packages. This course is often required for all undergraduates and is a prerequisite to other courses, such as accounting, finance, marketing, and operations management. Knowledge and skills gained in this course should enable students to not only understand "the mechanics" but also apply the learned skills to more complex problems during their business careers. Many entry-level positions, regardless of the discipline or industry, require some knowledge and understanding of several software application packages. Graduates of a business school are expected by their future employers to have mastered these productivity packages. Therefore, students in this first Information Systems (IS) course usually learn World-Wide Web searching techniques using a browser, an operating system, a word-processing package, a spreadsheet package and some presentation graphics. This paper provides some additional rationale for selecting self-paced software over traditional classroom instruction and also reports the outcomes of 24 students using self-paced multimedia instruction. Implications of this instruction method are discussed. Opportunities for future research are offered.

INTRODUCTION

Many university business schools have an instructor-led course introducing computer software application packages. This course is sometimes an independent class for little to no credit or linked with a survey lecture course in the form of a computer laboratory. It is often required for all undergraduates and is a prerequisite to other courses, such as accounting, finance, marketing, and operations management. The IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems includes a single prerequisite, the Knowledge Work Software Tool Kit, to the IS curriculum (Davis et al., 1997). This prerequisite to beginning studies in information systems requires basic software package skills including spreadsheets, presentation graphics, word processing, and Internet tools (Davis et al., 1997). IS '97 guidelines recommend that "this material can be delivered as self study modules, as modules associated with other courses using the software, or as a full course" (Davis et al., 1997, 18).

Faculty expect students to produce professional looking papers and presentations which contain information gathered using basic library and on-line research skills. Future employers expect business school graduates to have mastered these productivity packages. Therefore, students in this first Information Systems (IS) course usually learn Netscape and World-Wide Web searching techniques, Windows 95, a word-processing package, a spreadsheet package and some presentation graphics. Within the business school at this university, the integrated software suite taught is Microsoft Office including Word, Excel and PowerPoint.

There are many issues involved when teaching this skills course. Productivity tool instruction is provided during a weekly two-hour instructor-led computer lab held in a classroom environment, which accompanies a weekly two-hour lecture. The weekly two-hour lecture provides instruction in introductory theoretical Information Systems concepts. There are few problems with the lecture portion of the class. However, several issues arise in the formal computer lab.

First, the number of students is restricted to 20 due to a limited number of computers in the computer laboratory. Even this number can create great diversity among student participants. Students have different levels of operating expertise with respect to the software applications. These skills, either real or perceived, range from no expertise to those students currently utilizing the products in their part-time or full-time employment. Trying to prepare lectures and homework assignments for this array of skills is challenging. Aiming for the mean skill level causes some students to become frustrated and bored, while others are totally bewildered and lost.

Second, with multiple instructors teaching the same material, there is a potential for inconsistent presentation in terms of content, style, and scope of presentation. Different instructors may feel more comfortable with one subject matter while others have a stronger command of another's content. This difference in content familiarity and comfort may produce inconsistent presentations from instructor to instructor. Additionally, instructors have different presentation styles, which may affect the student's perceived or real quality of the instructor's dissemination of information. Instructors may select different scopes of presentation ranging from a step-by-step method of instruction to offering students possible usages of the products in a business environment. An intended outcome of the instruction is the student's ability to extrapolate from the knowledge and skills learned in order to produce business applications.

Third, students absorb information at different speeds. Some students require individual attention to perform the instructed task while others are capable of performing the task without assistance, causing a difficult learning environment. Some students need to repeat the instruction several times in order to achieve an adequate comfort level with the material. These levels of inequity have existed since these types of courses came into existence and make the learning environment difficult for many students and challenging for the instructor.

Fourth, the presence of computers in the learning environment can act as a distracter to students and the instructor. Students often want to practice the instruction while the instructor is providing instruction. While the hands-on method enables the student to experience the process firsthand, the clicking of keys may be disruptive. Disallowing students to simultaneously attempt the keystrokes during the instruction may frustrate some students whose learning is enhanced through kinetic instruction. Allowing students to simultaneously attempt the keystrokes during the instruction may frustrate auditory learners distracted by the sound of clicking keys. Instructors may find it difficult to compete with the clicking of keys.

These issues raise the question of using self-paced, interactive multimedia software as a replacement for instructor-led instruction of application packages. In an attempt to answer this question, 24 students used a self-paced, interactive multimedia software to learn Netscape, Windows 95, Word, Excel, and PowerPoint. This type of instruction was selected for several reasons. First, it allows students to work at their own pace, based on their initial level of expertise in the application, and to repeat, at any point, an area they are finding difficult. Second, students can use the self-paced software either on their own machine or on a university computer located at a campus computing facility. This affords the student greater control over their time as no designated laboratory is required. Third, the instruction content, style, and scope of presentation are consistent. Fourth, other students may not be present during the student's learning experience. Fifth, instructors answer specific one-on-one student questions as appropriate.

This paper provides some additional rationale for selecting self-paced software over traditional classroom instruction. It also reports the outcomes of the 24 students using this technology, discusses future implications of this instructional method for the productivity packages, and offers suggestions for future research.

RATIONALE

There are several reasons for considering an alternative instruction method for teaching software application packages. However, the questions of why, how and should these packages be taught at the university level arises.

Students and their potential employers expect universities to teach skills and knowledge relevant to their future business careers. All graduates are expected to have mastered these productivity packages. However, in teaching skill-based computer applications, an argument can be made that universities are becoming training centers or technical schools. This also raises the question as to the purpose of universities - educating or training students. "Education seeks broader, more generalizable capabilities, while the goals of training are more specific and task oriented. Education does not necessarily seek a practical or applied end; acquisition of knowledge for its own sake is a legitimate goal of education, but not of training.... The generalizable knowledge acquired in an educational setting often permits the individual to solve problems for which a training program would not be adequate preparation." (Mayo and DuBois 1987, p. 5)

If it is accepted that the purpose or goal of universities is educating, then teaching applications packages at the college level should be abandoned. Training students to use the packages is the development of a skill, where the emphasis is on *skill* rather than acquisition of *knowledge*. Ideally, students should enter their university careers with these skills already mastered. Twenty years ago, when these types of courses were introduced, they were temporary - it was assumed that within a short time, students would acquire these skills in high school or even grammar school. This has not fully materialized and there is still a need for this instruction. The question is how are these skills, given the present student population, to be delivered today.

As mentioned, students arrive in the classroom with varying levels of competence in the application packages. They may be proficient in one or more software packages, needing help in some, but not all. And those they know or think they know are 'known' at various levels of breadth and depth. They also arrive at the university with different learning styles and expectations. Newstron and Lengnick-Hall (1991, p. 46) list "Dimensions for Assessing the Trainee." These dimensions can be applied to students and Table 1 highlights the differences that influence the mastering of application or productivity software packages. Of course these dimensions exist in a lecture-type classroom setting, but the students are acquainted with that environment since first grade. These issues are more obvious within a computer lab/classroom environment; working with computers and software accentuates the differences.

When students can learn the skills required to use the application packages using an interactive multimedia software, concern about some of these dimensions can be eliminated, while others can be become more manageable. Some of the fear of the computer is eliminated, they can work on those portions of the package where they lack skill, and they can work at their own pace and redo portions that are unclear or they are not grasping. In essence they get individual attention. When they are bored, they can quit and return to finish. As they master the skills, they gain self-confidence to explore other areas of the software and expand their skill level. Additionally, they take the instructional software with them. In future courses, the software is available for them to return to unpracticed skills and to learn new ones. Although one of the preferred learning activities to acquire mastery of software is experimenting with software (Harp, Satzinger and Taylor 1997), most students rarely take that approach. Using the software, they can acquire a "learn-to-help-ourselves attitude" (Weldon 1996).

TABLE 1
DIMENSIONS FOR ASSESSING THE STUDENT

1. *Instrumentality* - the degree to which the student is concerned with the immediate applicability of the concepts and skills being taught. Students often do not think past the current course and do not see the relevance of the material until the following semesters	6. *Dominant Needs* - intrinsic and extrinsic individual needs that drive the student - the need for acquiring the skill or the need for a good grade.
2. *Skepticism* - degree to which the student exhibits a questioning attitude and demands logic, evidence and examples. They have heard that there is a great deal of work involved in the class and it is only 25% of their total grade.	7. *Absorption Level* - the pace at which the student accepts new information and masters the skills. Some will grasp one concept quickly and not another, while some are always behind the mean.
3. *Resistance to Change* - degree to which the student fears the course or computers in general.	8. *Topical Interest* - does the student have a personal interest in acquiring the skill. Many do not; some are enthusiastic.
4. *Attention Span* - length of time the student can spend on activity before losing interest. Not only the subject matter but also the instructor can influence this.	9. *Self-confidence* - the degree to which the students independently and positively view themselves - enables them to explore and discover solutions on their own.
5. *Expectation level* - level of quality (process) and quantity (content) that the student requires from the instructor. Students differ in the amount of individualized attention required to successfully complete the task.	10. *Locus of Control* - can the student use the skill without support of the instructor - on the homework assignment, in the following class, in the following semester, out on the job?

The interactive multimedia software also addresses the perceived generation gap between the "Baby Boomers" and "Generation X." These students are part of the "Generation X" learning the alphabet and numbers with Sesame Street and songs. Their values, communications styles and life experiences are different (Caudron 1997). They are more self-reliant, grew up with a computer in the home, expect immediate gratification and are used to being entertained. They can use a computer and get immediate feedback to their solutions, and it is more entertaining than sitting in a computer classroom working at a pace that is either too slow or too fast. When they use an interactive multimedia software for instruction, the onus is placed on them to complete the work, when and where they want - in the computer lab, in the dorm or at home, anytime of the day or night. The interactive multimedia software satisfies these requirements better than the assigned computer lab.

THE EXPERIMENT

Start-up

Volunteers were sought from the freshmen class. They were promised two course textbooks and software provided by the publisher, Course Technologies, specifically for this experiment. Additionally, if they successfully completed the exercises, they became exempt from attending the computer laboratory portion of the course next semester. The first twenty-four students to respond were selected with twenty-one completing the program.

An initial meeting was held in a computer classroom with the participants, the instructor in charge and the graduate teaching assistant. In this meeting, students received the course textbooks, software, data disks, assignments and a calendar with due dates. Instructions for using the software and course textbooks were included with the software. Students were provided with hands-on instruction in using the multimedia courseware. Participants completed an initial questionnaire and were pre-tested on Microsoft Excel. The data supported the belief that the students were less familiar with Excel than Word, and that there would be a greater chance for demonstrating skill enhancement. Due to perceived time constraints, the students were not pre-tested on all the software applications.

Timeframe

Six assignments were included in this program, one for each application and a final assignment that integrated elements from each application package. Students had six days to complete each assignment. Tutorials and assignments were completed independent of a designated computer lab time and classroom; the students worked independently. A computer lab was available for students to use or students could use their own or a friend's computer. Issues and questions were answered over e-mail or by a graduate teaching assistant available two hours per week. The graduate assistant also was responsible for grading the assignments. Graded assignments were returned 48 hours after receipt.

The Final Meeting

At the end of the six weeks, students again met in the computer classroom to complete an exit survey and to be tested on all applications. Students successfully completing the program received credit for the computer lab portion of the class. Successfully completing implies a grade of 80% or better on all the assignments. Students were randomly asked for verbal feedback regarding the software, the process, and the experience.

OUTCOMES

The pre-study questionnaire was administered before the students began work on the interactive multimedia software. Tables 2, 3 and 4 provide some insight into students' perceived level of computer expertise and familiarity with the targeted software packages. When asked at what age they first used a computer, 52.4% indicated they had used a computer at age 7 or younger (Table 2). One participant indicated that computer use began at age 17. The modal age when participants began using computers is age 7. Computer usage could include playing games. A high percentage of the students (91.7%) used computers in high school, had them at home (79.2%) and were able to access one outside of the assigned computer labs (91.7%) (Table 3). The ones available at the University could either be their own, a friend's or a roommate's computer.

TABLE 2
PARTICIPANTS' AGE AND AGE WHEN BEGAN USING A COMPUTER
n=24

Participants' Age	18 years	17 – 20 years old
Age When Began Using A Computer	7 years	3 – 17 years old

TABLE 3
ACCESSIBILITY TO COMPUTERS
n=24

	Frequency
Used A Computer In High School	91.7% Yes
Computer In Home While Growing Up	79.2% Yes
Personal Computer Available At The University On Which They Plan To Complete The Interactive Multimedia Courseware Instruction.	91.7% Yes

Most of the students used Netscape, Windows 95 and Word (Table 4). Ninety-five percent indicated they had previously used Netscape Navigator and the same percentage indicated that they had explored the Internet. Thirty-three percent expressed that it would be very easy for them to locate specific information on the Internet. Ninety-one percent indicated they had previously used Microsoft Word while only 29.2% said that they could easily create a Table of Contents in Microsoft Word. However, 50% said that they could generate their resume in Microsoft Word with no problem.

Less than 50% of the students used Excel or PowerPoint (Table 4). Fifty-four percent indicated that they had not used Excel and 45.8% indicated that they would either find it extremely difficult or would be unable to create a spreadsheet containing formulas that would automatically calculate their monthly expenses. When asked if they could generate a graph of their monthly expenses, 62.5% indicated that they were unable or would find it difficult. Only 12.5% indicated that they could create a PowerPoint presentation for use in a formal presentation.

Because the students were going to use interactive multimedia courseware to learn the other productivity packages, it was included on the questionnaire as an applications package. Only 5 students had experience with a similar package. Since such a high percentage of students had computers available throughout high school or at home, the level of usage of Netscape, Windows 95 and Word is higher than is found in a formal computer lab addressing the same subjects. The levels of usage of Excel or PowerPoint are consistent with those found in the formal computer lab.

TABLE 4
PARTICIPANTS' USE OF APPLICATION PACKAGES
n=24

	Yes	No	Don't Know
Interactive Multimedia Courseware*	5	13	6
Windows 95	24	0	0
Netscape	23	0	1
Word	22	1	1
Excel	11	10	3
PowerPoint	5	17	2

* Interactive multimedia courseware is included as an application package

After all the assignments were completed, the students completed an exit survey evaluating the ease of use (Table 5) of the software and its effectiveness to motivate their own learning (Table 6). Since several instructors may be teaching the required computer labs, consistency and quality of instruction is always an issue. Ninety percent of the students rated the interactive multimedia software's response consistent. Additionally, the software allowed the students to control where they were in the package (skip instructions, access specific parts) and to control the pace at which they worked. It appears that the interactive multimedia software met some of "Generation X's" requirements for working at their own pace, any place and any time. The majority of the students reported that the software's feedback on their work was positive, timely and informative, and that the overall motivation was good or excellent (Table 7). Again the interactive multimedia met one of "Generation X's" requirements for immediate feedback.

TABLE 5
EASE OF USE
n=21

	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable
Consistent Response	30.0%	60.0%	5.0%	0.0%	5.0%
Ability To Skip Instructions	47.6%	47.6%	0.0%	0.0%	4.8%
Access Specific Parts Of The Program	52.4%	42.9%	4.8%	0.0%	0.0%
User Controlled Pace	66.7%	33.3%	0.0%	0.0%	0.0%

TABLE 6
MOTIVATION
n=21

	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable
Package Motivated Student To Learn	19.0%	33.3%	28.6%	14.3%	4.8%
Feedback Was Positive	19.0%	52.4%	23.8%	0.0%	4.8%
Feedback Was Timely	4.8%	61.9%	23.8%	4.8%	4.8%
Feedback Was Informative	14.3%	76.2%	9.5%	0.0%	0.0%

TABLE 7
OVERALL MOTIVATION
n=21

	Excellent	Good	Okay	Poor	Not Useful
Overall Motivation	14.3%	52.4%	14.3%	14.3%	4.8%

As mentioned, in order to be exempt from the computer lab portion, the students had to achieve a grade of 80% or better on the posttests. Twenty-one students participated in the final phase of the experiment. Those that did not, stated that they volunteered for the project to gain the skills that would enable them to complete the computer lab portion of the class with a higher grade. Table 8 contains the averages achieved on the posttest and the number of students passing. It is interesting that the average for the Excel portion is higher than Word; students initially were more familiar with Word.

After working with the interactive multimedia software, overall students improved their performance on Excel (Table 9). Improvement ranged from -1.71% to 38.49%, with one student actually performing worse on the posttest.

TABLE 8
POSTTEST RESULTS
n=21

	Posttest Average	Number Of Students Passing *	Ranges
Windows 95	85.9%	16	70.0% → 94.4%
Netscape	86.9%	20	70.2% → 94.1%
Word	84.9%	18	66.9 % → 94.7%
Excel	84.9%	17	71.8% → 96.2%
PowerPoint	82.3%	15	67.2% → 99.6%
Average Total Score	84.9%	16	72.2% → 94.1%

* Passing is any grade 80% or higher.

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TABLE 9
EXCEL PRETEST/POSTTEST RESULTS
n=19*

	Pretest	Posttest **	Difference
Excel Results Average	67.96%	85.03%	17.07%

* Two pretests were invalid.

**One student did worse on the posttest than the pretest.

STUDENT PERCEPTIONS

Student comments, in verbatim, from the exit questionnaire are contained in Tables 10, 11,12 and 13. They liked the concept of working at one's own pace and learning the software. Positive comments are made about the hands-on learning or interactivity, and the ease of use for novices. On the other hand, some with more computer experience thought the software was too elementary. There are a few complaints about the length of the tutorials and their initial complexity. The students felt the software itself was easy to use and navigate. There were some printing problems and at times, those without access to computers outside the classroom lab had to wait for a computer. Additionally, the software recognizes only very specific commands and that annoyed the students. Overall, the students' reactions concerning the experiment and the software are more positive than negative.

TABLE 10
STUDENT COMMENTS ABOUT THE EXPERIMENTAL PROGRAM

Student Likes About The Experimental Program
"I loved the fact that you can do it when you want. Being able to do the work at your own pace, at the time of day/day of the week that is best for me made the program great. I liked having the complete syllabus from the beginning. This way we could plan ahead, see what we will be doing."
"I loved just having a due date and a set of things I needed to hand-in. It was all spelled-out with no confusion."
"Someone who doesn't know much about the computer can use it without outside help. It is also effective in the sense that we can do the tutorial again if we don't understand the material the first time we do it."
"I found the e-course software a close to ideal way of learning how to use Microsoft Office and Netscape. In each tutorial, there were step-by-step instructions and practice sections, which gave you a hands-on way of learning, as opposed to just clicking through and not being able to apply what was given in instructions. The program was very useful in learning the software, which is so much in demand today, especially for someone who has no prior experience with such software. Overall, the program served its purpose and was helpful in learning new software."
"While I was home, my mom's office need to file for taxes. Their accountant asked me to help so that the bill wouldn't be enormous. In any event, I was able to use a spreadsheet and he was impressed. This is definitely applicable to real life."

TABLE 11
STUDENT COMMENTS ABOUT THE EXPERIMENTAL PROGRAM

Student Dislikes About the Experimental Program
"Tutorials, at times, were too long."
"Too introductory for some students. I work at an Internet Service Provider and knew most of this. That's not the fault of the pilot program though. Does the university allow students to test out of the lab?"
"What I didn't like is that the tutorials were so long but that was about it. And even that I didn't mind so much because I wanted to really learn these programs."
"Students should meet with the teacher more than once at the beginning and once at the end."
"In the beginning, it would have been very helpful to have more explanation. The first tutorial sets I did I had problems because I wasn't exactly sure what to do. Perhaps having another "scheduled session" in the early stages of the program in order to facilitate any student difficulties would be helpful."
"When I had a problem, it was hard to get help in a timely manner."
"Since I don't have my own computer, it was sometimes difficult to start working when the lab was full."

TABLE 12
STUDENT COMMENTS ABOUT THE SOFTWARE

Strengths Of The Software
"You can go back and forth in topics."
"Good Examples."
"Ease of use."
"For people who are not familiar with computers it's great. It teaches everything from the beginning. "
"That you can start and stop where you like and take as much time as you need."
"Easy to operate/understand."
"You could set your own pace for doing it."
"It allowed me to use "short-cuts" on my school projects."
"The projects were fun and effective."
"Great help within easy program."
"Good quality of materials for intended audience."
"Self-paced learning is very effective."
"The program was good in every one of its tutorials and was a good teacher."

TABLE 13
STUDENT COMMENTS ABOUT THE SOFTWARE

Weaknesses Of The Software
"We should have more projects."
"The fact that it teaches everything from the beginning is very slow moving for the majority of college students because we are very familiar with everything already. "
"Hard to figure out some of the projects."
"The material might not be comprehensive enough."
"The way it presents the material might not be conducive to long term retention."
"It focuses a lot on vocabulary and I wonder whether this is beneficial."
"Because you're tested on the material shortly after reading it I wonder whether you learn it completely."
"Caused occasional printer errors."
"Software did not work well on my PC – it slowed everything down."
"Program took off points for misspelling."
"The checkpoint results could not be accessed after the first time, you couldn't go back and print checkpoints if you hit continue instead of print."
"There are many ways to do tasks, but usually the computer only accepts one way."

SUMMARY

In order to modify the way application or productivity software packages are being taught, 24 freshmen in a school of business volunteered to learn the same skills using an interactive multimedia software. They used the software independently; that is, they did not attend a computer lab session to receive instruction. Within 6 weeks they completed 6 tutorials and 6 related homework assignments covering Netscape, the World-Wide Web, Windows 95, and Microsoft Office, including Word, Excel and PowerPoint. Those that succeeded in mastering the skills are exempt from the computer lab portion of the required Information Systems class. On the exit questionnaire, the students' reactions concerning the experiment and the software are more positive than negative. Most of the negative comments were constructive criticism. All of the students seemed to benefit from the experience.

Use of the interactive multimedia software eliminated inconsistencies that arise when multiple instructors are teaching the same subject matter. The instructor or help is not always available when needed. Evaluation of the student's assignments by the software is more consistent than that of different (or the same) instructor. Using the software eliminated the inconsistencies between instructors and there are built-in help functions. Therefore, the software offers additional benefits to the lecture-based presentation.

Interactive multimedia software accommodates different learning styles. In a study by Bohlen and Ferratt (1996) both lecture-based training and computer-based training were evaluated for students with different learning styles. They concluded that the computer-based training was more effective for all learning styles. While the purpose of this experiment was not to replicate their study, one of the goals was to accommodate different learning styles for a different generation.

FUTURE

In the past, Freshmen, with the assistance of an upper-class mentor, attempted to learn the basics of the software productivity packages. This was not very successful. All incoming Freshmen students will use this interactive multimedia software in the fall. They will not follow the ambitious schedule of learning all applications using the tutorials and completing all assignments and projects in 6 weeks like the experimental group. It is expected that the tutorials, assignments, and projects will be completed as part of the first year development program over the students' first year of study. However, students not achieving an 80% on each of the applications packages must redo the work until they pass. They will need this score in order to register for the required Information Systems core course.

By requiring all incoming students to reach a certain level of proficiency, some of the computer lab issues should be mitigated. Instead of the wide discrepancy existing currently, they may all have the same baseline skill level. And this baseline level may be higher than previous attempts at achieving the basics of the application packages. Obviously, there will still be some students with more advanced skills, but the lower end should be eliminated. This will enable the computer lab material to become more relevant and challenging, with advanced topics and opportunities to extrapolate from just learning keystrokes, to completing more complex business problems using these software applications. Some of the advanced topics covered will include developing multiple linked organizational budgets and simulating "what-if" types of questions, generating statistical analysis of this information and understanding the larger implications of the figures to the organization. The instructor can concentrate on educating the students instead of training them.

Faculty members teaching in the MBA program are also interested in the outcome of this experiment. There are MBA students in their classes without the necessary computer skills. Faculty will be able to recommend this type of self-paced, self-learning activity to these students and not have to spend time bringing them to a skill level required to complete MBA assignments.

More companies are investing in training their employees. Everyone, the organization and the employee, benefits with increased productivity and profitability (Bergman 1995). On average, about 1.4% of payroll, $59.8 billion is 1996 (1996 Industry Report), was spent on training and it is projected that 75% of all companies with 50 or more employees will use computer-based training (Bohlen and Ferratt 1996). Since the use of computer-based training is becoming ubiquitous in the business community, the use of the software in the undergraduate business program prepares the students for life-long learning throughout their future careers.

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DEVELOPMENT OF MULTIMEDIA TEACHING MATERIALS FOR A COMMON SERVICE SUBJECT IN INFORMATION TECHNOLOGY

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It is anticipated that a large number of students will be taking some popular common service computing subjects in a credit-based system. These subject modules may be taught by different teachers; thus there is a need to ensure that students are taught uniformly with the same teaching materials. It is likely that mass lectures will be used in a credit-based system and well-prepared teaching materials must be available for effective learning and teaching. A set of common teaching materials to be shared by several staff can make staff resources better deployed. This paper is concerned with the production of the multimedia teaching materials in a common service subject. A CD-ROM which contains the multimedia teaching materials has been produced. The development of multimedia teaching materials has been undertaken in a common service subject, Information Technology. There is no doubt that the development process requires hardware, software, and human resources. This paper describes the characteristics of the teaching materials, the development process, the experience of the author, and the problems encountered in the development of multimedia teaching materials using Microsoft PowerPoint version 7.

INTRODUCTION

In view of the implementation of a credit-based system in The Hong Kong Polytechnic University starting September 1998, there will be a large number of students wanting to study some common subject modules in Computing. This popular subject module will be attended by many students and may involve several teachers. There is a need to ensure that students are taught uniformly with the same teaching materials. High quality teaching materials must be available for effective learning and teaching. A set of common teaching materials to be shared by several staff can make staff resources better deployed. The use of multimedia was applied to teach telecommunication (Yaverbaum and Nadarajan 1996). Also, multimedia can be used in educational settings (Smith 1997). The author undertook a Hong Kong University Grants Committee-funded Learning & Teaching project which was to develop teaching materials tailor-made for a common service module. The project consumed about US$5550 for the hiring of student assistants to be involved in the project. This paper is concerned with the production of the multimedia teaching materials in a common service subject in Information Technology. A CD-ROM which contains the multimedia teaching materials has been produced.

The development of multimedia teaching materials has been undertaken in a common service subject, Information Technology. There is no doubt that the development process requires hardware, software, and human resources. This paper describes the characteristics of the teaching materials, the development process, the experience of the author, and the problems encountered in the development of multimedia teaching materials using Microsoft PowerPoint version 7.

CHARACTERISTICS OF THE TEACHING MATERIALS

The service subject module, Information Technology includes topics on hardware, software, data communication, the internet, databases, information systems, and software packages. The subject is designed as an introductory subject in Information Technology. The teaching materials have been prepared with multimedia for a professional-look presentation and they are all contained on a CD-ROM. The materials provide consistent and common coverage for all teachers of the subject. As the lecture materials are readily available on a CD-ROM, the delivery of a lecture can be easy when the lecture room has the necessary equipment which includes a computer with CD drive and sound capability, a projector and a screen.

There is a main menu (see Figure 1) through which lecture topics are to be selected with an icon-based interface. This can be convenient to a teacher as there is no need to remember the file names of the various topics. The materials in each lecture topic are well-organized with suitable video, audio, clip art, and photos to hold the attention of the students. Diagrams, charts, tables, and short video clips have been included for illustrations.

It was decided that the materials should have a good presentation format. Every slide is provided in the most appropriate presentation format with good combination of text and background color to attract the attention of the students. Bullets and font size have been carefully chosen to add emphasis to the presentation materials. Templates have also been applied carefully. Students in the past commented that they prefer to have color transparencies in lectures. Some of the important points are highlighted with color to focus students' attention. Different topics use different colors to give a fresh appearance. Most of the slides are supported with note pages which can supplement the details of each of the text lines in the slides. Each topic is provided with references including World Wide Web (WWW) addresses from which students and teachers can purse further information about topics.

DEVELOPMENT PROCESS

Choice of Development Tools

The development of multimedia teaching materials can be performed using authoring packages e.g. Toolbook which offer a number of special effects and interactive controls. The disadvantage is that a certain amount of programming is required. Most teachers may not have the time to be involved in programming in the preparation of teaching materials. They are already busy being involved with other important activities such as research, administration, lecturing, giving tutorials, and marking assignments. Indeed, they require an effective presentation tool to assist them in the development of teaching materials for presentation. Furthermore, the materials should be able to be enhanced and/or modified without much effort.

Microsoft PowerPoint is a very popular presentation tool used extensively in both the academic and business environments. PowerPoint has the advantage that a teacher does not need to know the technical aspects of programming to use the software. PowerPoint facilitates the development, modification, and subsequent enhancement of presentation materials. Coles and Rowley (1996) and Fulton (1997) have described the facilities for effective presentation using PowerPoint.

Development of Multimedia Teaching Materials

The project involves multimedia which may include text, graphics, video-clips, photographs, and sound. The first step was to collect the latest information on Information Technology and prepare the text. A considerable amount of typing was necessary. The next task was to add multimedia objects and other special effects to the text. The materials were first developed using PowerPoint version 4 under Windows 3.1 and these materials were later transferred to PowerPoint 7. Most of the teaching materials (slides) are supported with note pages which can supplement the details of the main points in the slides. References and WWW addresses are added to the end of each topic so that teachers and students can make further investigations. In order to attract the attention of students, every slide is provided in the most appropriate presentation format with good combinations of text and background color. The template and bullets and font size have been carefully chosen. Some of the important points are highlighted with color. Some slides have been built with animation effects; for example, the typewriter text effect and laser text effect. The teaching materials have different fonts including Times New Roman, Arial, and Garamond, among others. The application of the Book Antiqua font gives a smooth and appealing appearance. Also, 'Handwriting' and 3D fonts have been included to give the presentation a special appearance. An icon-based user interface was later developed and the presenter can choose the topic to be presented by clicking the appropriate icon.

Hardware and Software Facilities for Multimedia Development

To save time and effort, it would seem logical to use readily-available multimedia object clips which can be purchased from third-party vendors and perhaps downloaded from the Internet. Many video clips were found to be not appropriate to the subject under development. It was decided to produce them directly.

However, before the multimedia objects can be produced, there is a need to know how to use both hardware and software facilities. One major issue was the lack of hardware and software in my department and also the lack of technical support in using these facilities. The lack of manuals was also one of the problems. Sometimes, the access of hardware and software facilities was made from other departments. For example, The production of the video clips and the production of the CD-ROMs required the help of the Educational Development Unit of The Hong Kong Polytechnic University. The following table summaries the hardware and software facilities that have been used in the production of teaching materials.

TABLE 1
MULTIMEDIA OBJECTS

Multimedia Objects	File Format	Software Requirement	Hardware Requirement
Sound(music)	*.wav	CoolEdit	Sound Card (Sound Blaster)
Video	*.avi	Adobe Premiere	Digital Video Camera Video Capture Card (Video Blaster)
Sound(Midi)	*.mid	Nil	Sound Blaster
Spoken sound	*.wav	Sound Recorder	Microphone
Presentation	*.ppt	PowerPoint	Nil
Photo	*.jpg *.bmp	PhotoShop 4.0 PhotoEnhancer	Digital Camera (Kodak)
Scanned image	*.jpg, *bmp	HP desk scan	HP Scanner
Clip arts	*.wmf	Clipart CDs	Nil
CD-ROM production	Nil	EasyCD ProI	Jazz or Zip drive CD-Writer
Diagram	Nil	PaintShop Pro	Nil

Production of Multimedia Objects

Video Clips. It is useful to present short video(s) in lectures to enhance learning and to stimulate the students' interest. It was felt that relevant video clips could be produced to show some situations that they have not seen before. Sometimes students may not be allowed to access an environment unless arrangements have been made. e.g. a computer center in which all hardware devices are installed. Many of them may have seen and used a PC but they have not seen a super computer or a file server. They have an opportunity to see the full environment of a computer center which is quite different from that of a PC terminal room. However, video clips can be down-loaded from the WWW or purchase from third-party vendors. It can also be time consuming to search for relevant clips to be incorporated into the teaching materials.

The production of good image quality video clips may require a digital video camera; otherwise, snapshots can be digitized using a scanner. One can adjust the resolution of the image. When a higher resolution is chosen, a larger file size will be required. For better quality of video effect, it is advisable to skip the beginning and the last portion of the video shot for later editing with transition effect. Video recording and editing software such as Adobe Premiere is required for accepting input from the digital video camera and for subsequent editing. It is also advisable to have several shots of the same scene before selecting a video for digitizing. Each video should be edited and compressed before linking to the presentation.

Incorporating multimedia objects in presentations requires many technical decisions. The Audio Video Interleaved (AVI) format is a convenient format for video clips which can be inserted into the presentation. Some videos are in QuickTime format which requires a QuickTime player for the show. The size of a video file occupies less space if it is in MPEG format. For example, a file in AVI format occupies 120MB/Min compared with a MPEG file of 18MB/Min. That is approximately seven times larger. It seems logical to convert AVI files to MPEG format. This can be done using file conversion software such as Xing Encorder. With an MPEG file, Xinger Player needs to be installed for the show. Moreover, a faster computer is required for playing the MPEG file as the file is compressed and subsequently re-converted at the time of playing. Thus, a particular file format requires an appropriate driver and player. It is essential to use a Jazz or Zip disk for backup and to work with in the subsequent editing processes. Because of size and speed considerations, the use of the ordinary 1.44 MB floppy disk is out of the question. Sometimes, a relatively small file can be compressed to store on a floppy disk and then de-compressed for using. When a presentation has video clips, the time taken to save, load and play the presentation slides is much longer. For example, it has been found that a 23.6 MB multimedia presentation file requires 1 min. 50 sec. for saving to hard disk. The problems with handling presentation materials with multimedia objects are the large file sizes. It is preferable to use a Jazz storage device for storage and for speedy backup. Windows 95 has a known problem that the system can fail easily. There have been some occasions when the original file was corrupted when the file was being saved to the hard disk.

Photo Clips

Students may not have seen equipment such as an uninterruptible power supply, a repeater, line printers and others. These real objects can be brought to the class environment for demonstration or illustration. A digital camera can be used to create a picture of interest to be inserted into the presentation. Normal cameras have better quality. Digital cameras are easier to use. One additional feature is the ability to change the resolution of the image. Software is required to convert the digital camera format to that of a photo image format such as JPG. A photo image can be either JPG or BMP format and the JPG one occupies less space. However, Digital Photo format needs to be compatible with PowerPoint 7. A black and white image requires less disk space compare with color images but color pictures are more informative to students.

A scanner can be used to capture an image of a standard photograph. In fact, any object with a flat surface can be considered for duplication using a scanner rather than taking a photo. e.g. an image of a smart card. Experience has shown that the original picture should not have a glossy or bright color surface in order to obtain a good quality image. Some illustration materials can be scanned and then later incorporated into presentations.

Audio Clips

It may be worthwhile to include short music at the beginning of a lecture when all students have not yet arrived. The first slide of the presentation (with the heading of the topic) is the logical place to insert a light music clip. The idea is not to provide entertainment to students but rather students can be able to relax a while before the lecture starts. Some topics are not interesting but they are important. e.g. a topic on standard documentation which may not be easy to stimulate the interest of the students but a relaxed environment may help. It took some time to choose some light and relaxing music to be played. Audio editing software can be used to edit an audio sound track from a regular music CD and select the best tone of it. The music can repeat itself again when it comes to the end. This also reduces the size of the audio file. There are many sound recording formats. Most presentations use 16 bit sound at 22khz which is quite adequate when sound is inserted as a media clip. The media player must be used to control the sound. The sound file used in this project is 8 bits at 11 kHz with mono play which will take up less file space compared with a sound file of the same length of 16 bits at 44 kHz with stereo play. e.g. A song which lasts for 2 minutes 47 seconds with 8 bits 11 Hz requires 1.8 MB whereas with 16 bits 44.1 kHz requires 28.8 MB.

After the music/midi clip has been inserted in the slide, an icon representing the clip, (a *thumbnail)* will appear on the slide. The music/midi will automatically be played once the slide has been loaded. The audio will be terminated once another slide is to be shown. In order not to show the *thumbnail*, the size of the icon has been resized to a small dot and it is hidden in the dark area of a picture on the slide. However, it is sometimes difficult to locate the dot. For maintenance purpose, another solution would be to place a rectangle object (with no border and colored the same as the background) in front of the icon.

Teaching materials can be inserted with spoken sound. The video clips have been incorporated with spoken sound. The decision was not to include spoken sound in the teaching materials more than necessary otherwise it will turn into self learning material. It may have impact on teachers if more and more self learning materials are produced. It is generally agreed that students should be taught by teachers in lectures. Later, students can use other facilities to assist them to learn.

Clip Art

The Microsoft Clipart Gallery has a good number of graphics available. Clip art can be inserted not only to add interest to a presentation and they can be informative. Sometimes, they can emphase specific points and have special effects. For example, a pair of scissors is to be included in a presentation when talking about the Delete function of word processing software. Clip art can be obtained from a number of sources: the clip art file within

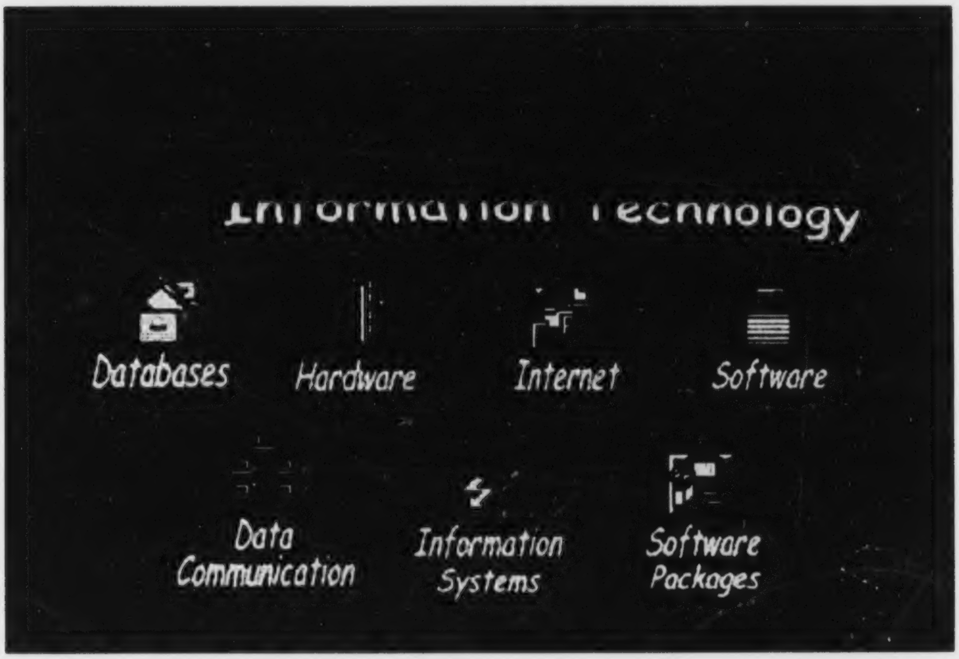
PowerPoint, third-party software vendors, downloading from the internet, scanned images, and drawings. The presentation materials used in this project were obtained from the Clip Gallery as well as cartoon clip art from a third-party vendor. One must be careful not to violate copyright of designated materials.

STRUCTURE OF PRESENTATION MATERIALS

The teaching materials for each topic were first developed and each topic forms a file and can be used directly for presentation. A main menu has been prepared to serve as a link among the lecture topics and to provide an easy human-computer interface. Each topic is associated with an icon which can be selected by clicking it. Each topic consists of a number of slides some of which have been linked to multimedia objects. Each slide within a topic can be linked to multimedia object(s) which can be linked to another slides and can be linked back to itself after invoking. The topics of presentation materials are arranged in a multi-level tree menu fashion. The main menu and sub-menus provide an icon-based interface from which the teacher can choose a topic by selecting the required icon and the relevant materials will be loaded for use.

The main menu has a rotating logo of the university. The visual impact of the slide is the combination of the background color, the text color and the well-chosen icons. Light music will automatically be played once the slide has been loaded. Figure 1 below shows the main menu and Figure 2 demonstrates the sub-menus.

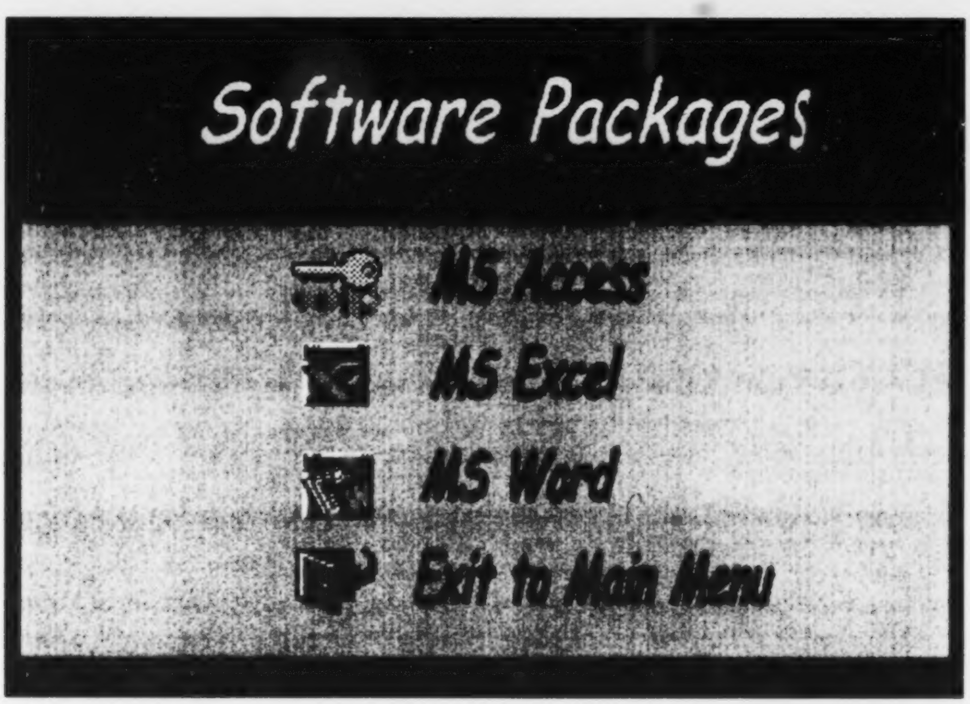
FIGURE 1
MAIN MENU



BEST COPY AVAILABLE

EST COPY AVAILABL

FIGURE 2
SUB-MENUS



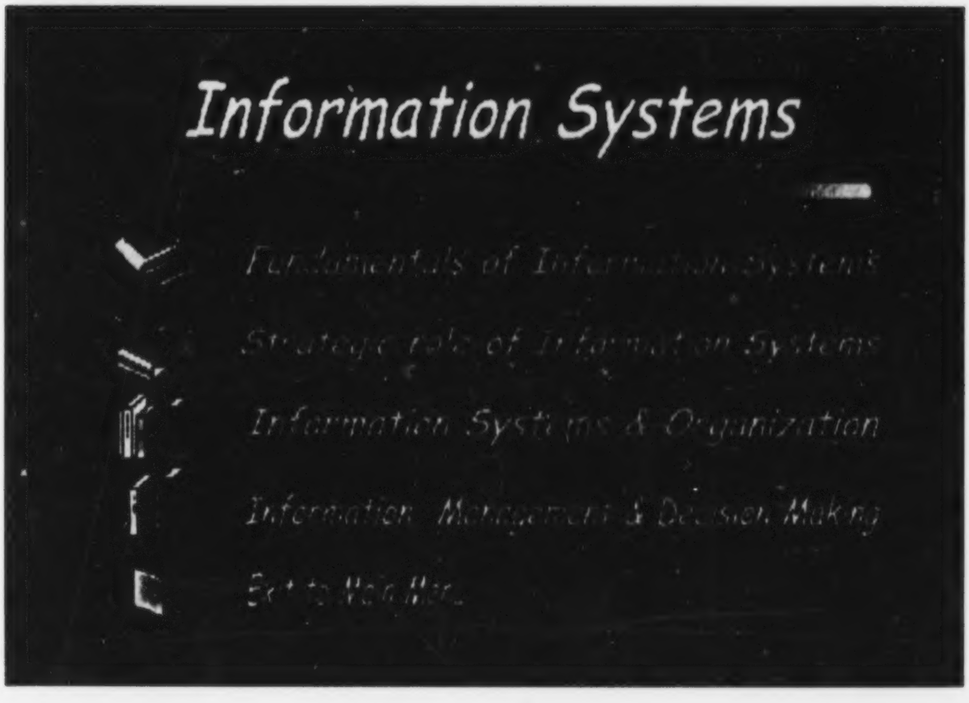
Software Packages

MS Access

MS Excel

MS Word

Exit to Main Menu



Information Systems

Fundamentals of Information Systems

Strategic role of Information Systems

Information Systems & Organization

Information Management & Decision Making

Exit to Main Menu

BURNING OF CD-ROM (COMPACT DISK-READ ONLY MEMORY)

Because of the large file sizes that are involved with multimedia materials, it is beneficial to have a CD-ROM as an end product which holds all information on one disk. It will be more convenient for the teacher to carry the CD-ROM to the lecture theater assuming that a computer with CD drive and projection unit are available. When files sizes are large, we need to consider loading time & system requirements. The following table provides some examples of multimedia objects of large file size:

TABLE 2
LARGE FILE TYPES

File Types	Playing Time	Size
Video (*.avi)	C_room.avi (26 Sec)	14.91 MB
	Superc_1.avi (42 Sec)	25.16 MB
Music (*.wav)	DataBase.wav (3.55 Min)	2.59 MB
	DataCom.wav (4.22 Min)	2.89 MB
Midi (*.midi)	A_bridge.mid (40.53 Sec)	7.33 K
Scanned image	Nil	1.97 MB
Photo (*.BMP)	Nil	1.97 MB

The process of creating a CD-ROM is accomplished using a CD-ROM writer. Several versions of the PowerPoint materials were produced before the final version evolved. It was found that not every copy of CD-ROM could be successfully produced. The early production could be read by some computers but not by the others. The reason was due to the incompatibility of the Windows version chosen for the development of the material and the subsequent production of the CD-ROM. For example, the burning of the CD-ROM used Windows 97 and the development of teaching materials used Windows 95. One end result was that an AVI formatted file could not be played.

PROBLEMS ENCOUNTERED

PowerPoint offers a number of attractive templates of bright colors and different designs. It was first tempting to select these attractive templates, some of which have colorful borders. As some slides contain considerable amounts of information to be presented, it was found that these templates were not appropriate because the borders took up too much space. Thus a plain background was chosen.

Drawing tools provided by PowerPoint version 7 are not effective for drawing graphics/pictures/charts. Other drawing software had to be used instead and then the resultant pictures imported into the PowerPoint presentations.

The color combination of slides is dependent on the color resolution of the monitor. Different monitor models will have different effects on the same slides. Some high resolution monitors will have much more color combinations than low resolution monitors. It is recommended to be consistent when producing and showing the slides with the same setting. The best way is to develop the materials using 256 colors on low resolution monitors then the appearance will be predictable on all machines.

Windows 95 is renown to be unstable and files may have been corrupted in the middle of editing. It is advisable to save the working file as often as possible. When large files are used, the time taken could be significant when the mass storage was not used. Mass storage devices such as Jazz or Zip drives were needed because multimedia object files are very large.

Students expect multimedia to be of the quality that appears on TV. Therefore, any video clips, for example, need to be new, interesting, informative, and high quality. The presentation designers need to incorporate visuals, for example, supercomputers, tape libraries, and smart cards.

CONCLUSION

The author has described the experience of producing a multimedia support tool for a common service subject, Information Technology using PowerPoint version 7. The preparation of multimedia teaching materials is a time-consuming process. It requires a great deal of resources in terms of human, hardware, and software availability. It required long hours of project management efforts in checking and proof reading the materials. More importantly, it requires intensive technical support. The development of multimedia teaching materials requires considerable thought in incorporating meaningful audio and video files into the presentation. The materials can be further enhanced with PowerPoint 97.

There are a number of questions which need to be addressed. One question is "Should teachers spend so much time and effort in producing multimedia materials to stimulate the interests of the students to learn ?". Many academic departments may not have the resources to support this kind of work. However, it is generally agreed that if students are motivated to learn, the task of teaching can be easier. The use of multimedia presentations can help to enhance the learning and teaching process.

Further research should be made to investigate the cost effectiveness of using multimedia presentations in teaching. Another research question is "How much better students can learn with multimedia presentations?". Can all subjects apply multimedia technology to all levels of students successfully? Considerable amounts of time and resources are required of academics who also have research and administrative demands.

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TECHNOLOGY SKILLS IN DEMAND: A SURVEY OF JOB ADVERTISEMENTS IN NEW ENGLAND

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To identify the IS skills in greatest demand in Connecticut and the New England region, classified ads appearing the region's major newspapers during the summer of 1998 were analyzed. This paper highlights these findings and compares them to the skills employers from other regions have deemed important. It also suggests curriculum implications for MIS educators and directions for future research based on longitudinal assessment and comparison with other regions of North America.

INTRODUCTION

To address the overwhelming demand for technology-literate workers in New England, a survey of major regional newspapers was taken to determine which skills were in greatest demand by employers. Students and faculty alike are aware of the insatiable demand for skilled knowledge workers with a strong background in technology concepts. The challenge faced by the faculty and curriculum committees is to assess their current course offerings to determine which skills are still applicable and which, if any, are no longer needed.

Local and regional employers in New England are having a difficult time hiring competent, skilled workers with a strong information technology background. One only needs to read the headlines of articles in newspapers like the *Hartford Courant*--"A common plea, 'Help wanted': Will a shortage of workers slow growth of state's economy?" and "The frustrating search for workers: Information technology jobs go begging in Connecticut"--to get an idea of the magnitude of the problem. Primarily due to a changing business climate, relatively high cost of living, and the loss of over 50% of graduating high school seniors to other states, Connecticut, in particular, has a difficult time finding and keeping technology workers. While it is beyond the scope of this paper to address the cost of living or migration issues, it will attempt to determine which technology skill sets are necessary and in demand by employers and how colleges and universities should respond to these needs.

Several previous studies have looked at the classified ads for trends and skills. Many recent papers have focused on other specific regions, such as the Middle Atlantic states (Jacobson and Armstrong, 1996) or the Southeastern region (Case, Price, and Rogers, 1997). It has been several years since a comprehensive study of the New England region was conducted (Athey and Plotnicki, 1992; Arnett and Litecky, 1994; Prabhakar, Litecky, and Arnett, 1995). This paper will use a methodology similar to that undertaken by Jacobson and Armstrong (1996) and Case, Price, and Rogers (1997). The focus, however, will be exclusively on the New England region.

METHODOLOGY

This study has attempted to determine which skills are in demand by employers in the greater New England region by analyzing classified ads for information systems jobs using the five largest newspapers in the region. Ads from both the actual printed classifieds as well as the Internet web sites of these newspapers were included. This is the first attempt at investigating the regional needs of New England businesses. Follow-up studies are planned for the future to determine the longitudinal implications of these skill sets. Such future surveys will attempt to replicate these findings and determine whether the changing economy in New England is reflective of the courses offered and skills taught by colleges and universities.

A pilot-study of IS job ads was conducted during April, 1998 from advertisements found in the Sunday edition of the *Hartford Courant*, Connecticut's largest daily newspaper. The resulting matrix of skills and competencies was used to assess several regional New England papers during the summer of 1998, thereby providing a more comprehensive assessment of IS job skills in New England.

The papers selected for this study included the Sunday edition of the *Hartford* Courant (covering greater Connecticut and Western Massachusetts), the *Boston Globe* (covering most of eastern Massachusetts, the south shore and northern New England), the *Worcester Telegram and Gazette* (covering central and western Massachusetts and northeastern Connecticut), the *Providence Journal-Bulletin* (covering Rhode Island and south eastern Connecticut), and the New England edition of *The New York Times* due to the proximity of southwestern Connecticut (Fairfield county) to New York City. For the first two months we also included the *Portland Press Herald* (covering Maine), the *Union Leader: New Hampshire Sunday News* (covering New Hampshire) and the *Rutland Tribune* (covering Vermont) in our study. These papers were dropped from the study in subsequent months due to the limited number of job postings encountered in each of these papers. Since both the *Boston Globe* and *Worcester Telegram and Gazette* advertised for more positions in these areas than the respective local papers mentioned above, the author contends that it would not compromise the study to drop these three papers from the analysis.

Analysis of Ads

Following the coding of previous studies (Jacobson and Armstrong, 1996; Case, Price, and Rogers, 1997), more than one hundred criteria were used to group several categories such as general job skills, information systems skills, programming languages, hardware platforms and operating systems, database skills, networking topologies and structures, application packages, specialized development software and educational backgrounds. The same coding methodology was employed as that used by Jacobson and Armstrong (1996).

The study was limited to ads for business-oriented IS positions placed by organizations for their own work force and to ads placed by consulting firms who hire individuals to work for them. If the advertisement was for a specific number of positions, with a particular set of skills, the need for those skills was tallied for that number. However, when the number of positions to be filled was not indicated, the skill was tallied only once (p. 45).

Thus, by using a similar classification scheme, it is possible to compare the demand for positions and skills across both cities and time periods. It also allows for replication of the study in the future and provides a means with which to compare New England to other regions. To address reliability concerns and enable comparison with earlier studies on different regions, all information systems ads were scanned and only those ads that met the criteria noted above were included. Ads for IS sales positions, teachers, and non technical personnel were not included in the survey.

RESULTS

Since the coverage of these papers sometimes overlaps, they have been analyzed with respect to geographic region rather than a specific metropolis. This provides a look at skills needed in the different regions of New England, each of which has its own industrial and technical niche. The *Hartford Courant* and the New England edition of the *New York Times* was used to assess job skills in central and western Connecticut and western Massachusetts, the *Providence Journal Bulletin* was scanned for job skills in Rhode Island and southeastern Connecticut, the *Worcester Telegram and Gazette* was used for Central and Eastern Massachusetts, and the *Boston Globe* was scanned for job skills in metro Boston and northern New England. Thus, jobs in the New England region can be attributed to one of the five papers studied.

As illustrated in Table 1, a total of 2,639 information systems advertisements appeared in the five New England papers on the first Sunday of June, July, and August 1998. The ads were analyzed using the methodology described above and the results were tabulated and analyzed using an Excel spreadsheet.

With respect to general job skills, those in the greatest demand were interpersonal and communication skills and problem solving and analytical skills. Table 2 illustratedthe percentage of ads requesting the specific skills mentioned above.

TABLE 1
NUMBER OF ADS FOR EACH CITY'S PAPER BY MONTH

	The Hartford Courant (CT)	New York Times (NY)	Providence Journal Bulletin (RI)	Worcester Telegram & Gazette (MA)	The Boston Globe (MA)	New England Region **Totals**
May	142	344	34	27	174	721
June	128	296	22	18	136	600
July	139	327	41	22	157	686
August	109	353	28	13	129	632
Totals	518	1320	125	80	596	**2639**

TABLE 2
GENERAL JOB SKILLS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Coordination & Project Management	8%	9%	7%	10%	8.5%
Interpersonal & Communication Skills	10%	12%	9%	11%	10.5%
Problem Solving & Analytical skills	9%	8%	10%	13%	10%
General Job Skills	6%	5%	4%	6%	5.25%

TABLE 3
INFORMATION SYSTEMS SKILLS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Design & Development	6%	8%	7%	9%	7.5%
Y2K (Year 2000)	3%	4%	3%	3%	3.25%
Hardware & Software Implementation	5%	5%	4%	6%	5%
Networking & Telecommunications	9%	6%	10%	10%	8.75%
Operations & Maintenance Skills	5%	4%	5%	4%	4.5%

The information skills in greatest demand were design and development and networking and telecommunications. This is in line with previous studies of other regions. The demand for networking and telecommunications is probably due largely to recent developments in Internet technologies and the availability of database programs for the P.C. Surprisingly, there was little mention of Y2K (Year 2000) skills. This might indicate that employers are looking for specific skill sets rather than general Y2K knowledge. Table 3 delineates the most common IS skills. As expected, the educational background requested by most employers was that of a bachelor's degree. This is in line with previous studies of other regions (Case, Price, and Rogers, 1997; Jacobson and Armstrong, 1996; Prabhakar, Litecky, and Arnett, 1995). There was also a demand for employees with advanced degrees, probably due to the New England region's large number of college graduates and college educated employees. Professional certifications were mentioned quite often, particularly Microsoft's MSCE and Novell's CNE. Less than 5% of the jobs required more than 5 year's of experience. This is probably due to the nature of classified advertisements--more entry-level jobs are placed in print media. Table 4 breaks down the education and training requirements.

The hardware platform in greatest demand was that of the PC. This was followed closely by mainframe systems and mini- and mid-range systems. This appears to reflect a nationwide trend in migration toward PC and client/server systems and away from mainframe and minicomputers. The greater demand for mainframe systems skills over the Southeastern U.S. (Case, Price, and Rogers, 1997) is probably the result of more insurance and financial firms headquartered in New England and their reliance on older platforms. In fact, many of these firms continue to employ mainframe and midrange systems and are just beginning to migrate to client-server and PC-based platforms. Table 5 illustrates the hardware platform requirements.

Windows NT was the operating system mentioned the most often, followed closely by Windows 95 and Windows 98 and UNIX. There is a definite trend toward PC based operating systems and away from mainframe systems as shown in Table 6. Interestingly, DOS was still mentioned 5% of the time and DCL (used on Digital minicomputers) was in greater demand in Central and Eastern Massachusetts and Northern New England, presumably due to Digital's strong presence in New Hampshire.

TABLE 4
EDUCATIONAL/TRAINING AND YEARS OF EXPERIENCE

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
MSCE/CNE/CNA	14%	9%	3%	10%	9.25%
Bachelor's Degree	33%	20%	24%	28%	26.25%
Advanced Degree	4%	3%	2%	4%	3.25%
1-2 Years Experience	17%	15%	18%	22%	18%
3-5 Years Experience	19%	18%	13%	18%	17%
5 + Years Experience	5%	6%	4%	5%	5%

TABLE 5
HARDWARE PLATFORMS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Personal Computers	28%	25%	20%	30%	25.75%
Client/Server systems	10%	13%	15%	14%	13%
Mini- & Mid-range	12%	10%	7%	15%	11%
Mainframe systems	17%	18%	12%	15%	15.5%

TABLE 6
OPERATING SYSTEMS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Windows NT	18%	15%	12%	17%	15.5%
Windows 3.x/95/98	11%	11%	10%	9%	10.25%
UNIX	11%	10%	8%	14%	10.75%
AS/400	7%	2%	1%	3%	3.25%
Novell NetWare	10%	5%	4%	6%	6.25%
JCL/MVS	2%	3%	2%	5%	3%
DCL	2%	5%	1%	7%	3.75%
DOS	4%	5%	4%	6%	4.75%

The programming languages most in demand were COBOL, C++, and Visual Basic. COBOL was in greatest demand in Connecticut and Rhode Island and C++ was most often requested in Central and Eastern Massachusetts, Metro Boston and northern New England. This is probably due to the need for Y2K compliance issues and the large number of insurance firms in Connecticut which employ older legacy systems. Overall, the New England region is in line with the Southeastern U.S. (Case, Price, and Rogers, 1997) and in the Middle Atlantic states (Jacobson and Armstrong, 1996) with respect to programming languages. While the order of importance may vary slightly, it appears that demand for non object-oriented programming languages is the result of maintenance on legacy systems and the demand for visual programming languages (i.e. Visual Basic and C++) reflects the focus on new development in a GUI environment. Table 7 illustrates the breakdown by language.

Specialized application package needs varied by sub-region. This is also not surprising given the different types of business found in each area. The applications consistently in greatest demand were MS Office 95/97, Powerbuilder, and CICS. There was more of a demand for CICS in Connecticut and Central Massachusetts, probably as a result of larger numbers of insurance and financial firms in the area.

Database skills made up a large percentage of the total number of ads. Among the specific systems mentioned, Oracle was first, followed by DB2, Sybase, and Access. This appears to be a national trend as ads from the Southeastern U.S. (Case, Price, and Rogers, 1997) and the Mid-Atlantic states (Jacobson and Armstrong, 1996) also demand these skills. It appears that Oracle and Access are used in PC-based development and Sybase and DB2 are used primarily in mainframe systems. Table 11 illustrates the needs for particular database skills.

TABLE 7
PROGRAMMING LANGUAGES

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
C	11%	10%	2%	14%	9.25%
C++	13%	15%	7%	18%	13.25%
COBOL	15%	14%	21%	14%	16%
JAVA	7%	4%	4%	5%	5%
HTML/VRML	2%	2%	4%	4%	3%
VISUAL BASIC	12%	10%	7%	14%	10.75%

TABLE 8
SOFTWARE APPLICATIONS & SPECIALIZED TOOLS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
CICS	12%	11%	1%	3%	6.75%
Lotus Notes	3%	2%	1%	2%	2%
MS Office 95/97	9%	12%	11%	8%	10%
MS Exchange	1%	1%	2%	2%	1.5%
Smartsuite	1%	0%	0%	1%	0.5%
Powerbuilder	7%	8%	6%	6%	6.75%
COBRA	4%	2%	0%	4%	2.5%

TABLE 9
DATABASE SYSTEMS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Access	9%	10%	7%	4%	7.5%
dBase	2%	3%	0%	1%	1.5%
DB2	13%	12%	3%	8%	9%
FoxPro	5%	3%	2%	2%	3%
IMS	4%	5%	1%	1%	2.75%
Oracle	16%	14%	14%	15%	14.75%
Sybase	9%	8%	5%	10%	8%

DISCUSSION

Comparing the results of jobs available the New England region with that of the Middle Atlantic states (Jacobson and Armstrong, 1996) and the Southeastern U.S. (Case, Price, and Rogers, 1997), some interesting similarities and disparities surface. With respect to basic business skills, many employers sought coordination & project management ability, strong interpersonal & communication skills, and problem solving & analytical competence. This supports findings from the other regions. Basic skills are a necessary co-requisite for a position in information systems.

The operating systems in greatest demand in New England are Windows NT, followed by Windows 3.x/95/98 and Unix. This differs slightly from the Mid-Atlantic states where a greater demand for UNIX exists than for Windows NT (Jacobson and Armstrong, 1996).

The percentages for New England are much more closely in line with that of the Southeastern U.S. (Case, Price, and Rogers, 1997), perhaps suggesting that different industries (i.e. insurance and finance in New England and the Southeast compared to government and public service in the Mid-Atlantic) may have unique needs.

The movement toward PC and client/server based computing is evident by the greater number of ads requesting these skills. This also appears to be a national trend as firms begin to move programs and data from mainframe systems to a more distributed environment. Mainframe skills continue to be in demand in New England more so than in other regions. This may be the result of a larger number of insurance and finance firms that still employ legacy applications written for the mainframe. The movement away from such systems is evident, albeit at a slower pace than other areas of the country.

Greater reliance on mainframe systems may also explain the dominance of COBOL for programming in New England. While COBOL is also requested in other parts of the country, many students from Connecticut take positions in the local insurance companies as COBOL maintenance programmers. New development, like other areas of the country, appears to be in the visual programming languages like C++ and Visual Basic. There is also increasing demand for C and JAVA, indicating a movement toward web-based development.

Like other parts of the country, database skills continue to be in great demand in New England as well. The primary skill set is Oracle, which is also the most often requested in other areas of the country (Jacobson and Armstrong, 1996, Case, Price, and Rogers, 1997). However, unlike the other regions, DB2 and Sybase are the next most demanded database language in New England. Again, this may be explained by the large number of firms still using mainframe systems. The rest of the findings are consistent with those reported by Jacobson and Armstrong (1996) and Case, Price, and Rogers (1997).

Curriculum Implications

Comparing the needs IS employers in New England have requested with what the students have been taught provides a strong impetus to assess the current curriculum. According to recent MIS graduates in Connecticut, Connecticut State University (CSU) seems to be doing well in preparing students for the working world. There is, however, a need to for greater emphasis on business skills, especially oral, written, and presentation skills. This is supported by employers as they have requested these "soft" skills as co-requisites to the "technical" skills. With respect to the "hard" skills, students felt prepared in networking, systems analysis, and database theory. The expressed a need to learn specific skills such as Oracle, Powerbuilder, C++, and Microsoft certification. This presents a dilemma for MIS educators. Do we teach the latest hot skills or do we teach concepts that students can adapt to changing requirements and technologies? This author concurs with Case, Price, and Rogers (1997), who suggest that universities must emphasize lifelong learning and students should be provided with a strong conceptual foundation with which they can acquire and adapt to new skill sets to meet changing business needs.

Employers in Connecticut face many of the same needs as other areas of the country. Students in MIS are few and jobs are plentiful. Unfortunately, while a large portion of CSU graduates live and work within a 40-mile radius of Hartford and the campus, an increasing number a choosing to take positions outside Connecticut and even New England. The national demand for information systems skills might shed some light on why Connecticut, despite a strong technological economy and excellent educational system, continues to lose IS graduates to other cities and states. As educators, we must do our part to assist students in the learning process and prepare them for the dynamic global business environment.

Future Research

Over the past few years, three distinct regions of the U.S. have been analyzed with respect to information systems job skills and employer needs. The next logical steps are two-fold. Analysis of other areas of the country (e.g. the Midwest, the West coast, the Pacific Northwest) is needed to yield comparisons across North America. Longitudinal studies should also be conducted in the coming years to determine whether the analyses reported herein are long-term trends or short-term needs. By tracking information skills over time, it will be possible to forecast which skills will likely be needed in the near future, which are in current demand, and also which skills are quickly falling out of favor among employers. Such research will assist universities in development of local courses as well as national MIS curricula (Gorgone, and Gray, 1998) to meet the dynamic needs of employers and employees as we prepare to enter the next millenium.

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USING TRAINING ADS TO IDENTIFY HIGH-DEMAND IS/IT JOB SKILLS AND COMPETENCIES

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IS educators and administrators are continually challenged to offer a curriculum that appropriately balances employer needs, accreditation requirements, and university realities including budget and staffing constraints. An important aspect of addressing this challenge involves staying abreast of the evolution of high-demand IS/IT skills. Numerous universities and educationally-oriented researchers have turned to survey research, advisory boards, and content analyzing newspaper want ads to provide guidance in keeping their curricula and IS course contents up-to-date. While such approaches can provide insight into the range of skills that employers are looking for, including the relative demand for particular skills, they may stop short of identifying emerging skills and/or the especially "hot" skills that organizations are willing to pay a premium for. The current investigation was undertaken to determine whether the content analysis of IS/IT training ads in newspapers and on-line is superior to the content analysis of newspaper ads in identifying high/demand and/or emerging IS/IT skills. The findings suggest that content analyzing training ads can provide IS educators with greater insight into high-demand IS/IT skills than can be observed in newspaper want ads. The findings also suggest the contents of IS/IT want ads are superior to training ads in their attention to "soft" skills and enduring concepts that serve as cornerstones for lifelong learning. Universities are typically better positioned than training firms to help students develop the "soft" skills; training firms may be better positioned than universities to help trainees develop particular technical skills and competencies.

INTRODUCTION

Ensuring that IS program graduates possess skills and abilities sought by employers is an important issue among conscientious IS educators. IS educators (both faculty and program administrators) are continually challenged to craft curricula that satisfy a variety of criteria including:

- meeting accreditation standards
- up-to-date content
- sufficient breadth to ensure a foundation for lifelong learning
- courses, skill development and internship experiences that provide students with the background required by employers
- curriculum (and course) content that prepare students for graduate programs.

Simply identifying curricular content that satisfies labor market needs can be a daunting task in an age when the shelf-lives of technical skills are becoming shorter and shorter.

IS educators have utilized a variety of approaches to stay abreast of IS/IT skills demanded by employers. Numerous investigators have utilized questionnaires to identify industry needs including surveys of companies who have hired program graduates, surveys of potential employers of program graduates, and surveys of program alumni. Other researchers have content analyzed newspaper want ads in order to identify the relative demand for specific skills and abilities among employers. Studies that have analyzed newspaper ads include Arnett and Litecky (1994), Athey and Plotnicki (1992), Case, Price, and Rogers (1997), Jacobson and Armstrong (1996), McLean and Schneberger (1997), Prabhakar, Litecky, and Arnett (1995), and Todd, McKeen, and Gallupe (1995).

A common purpose of most of these investigations has been to determine the IS/IT skills, and educational/practical background(s) sought by employers. Most were undertaken to gather curriculum-relevant information that could be used to select of programming languages, software tools, and other information technologies that could serve the dual purpose of illustrating (enduring) course concepts and providing skills that would help graduates get jobs.

The 1997 study conducted by Case, Price, and Rogers is illustrative of the general approach that is used in the investigations that have content analyzed newspaper ads. Classified ads for IS jobs listed in the Sunday editions of the *Savannah Morning News*, the *Charlotte Observer*, and the *Atlanta Constitution* collected during the Spring of 1997 were used to develop a grid of IS/IT skills/competencies. The grid, implemented as an Excel spreadsheet, consisted of approximately two-hundred distinct skills/competencies grouped into umbrella categories including general job skills, IS skills, IS certifications, educational backgrounds, programming languages, operating systems, hardware platforms, networking technologies, application packages, database technologies and development tools. The grid was subsequently used to analyze the content of more than 700 IS want ads that appeared in the major newspapers published in Atlanta, GA, Birmingham, AL, Charlotte, NC, Columbia, SC, Jacksonville, FL, Miami, FL, and Tampa, FL. on the first Sunday in June, July, and August, 1997.

A subset of the findings of the Case, Price, and Rogers (1997) investigation that is especially relevant to the current investigation are summarized in Tables 1 - 4. It is important to emphasize that Tables 1-4 represent a subset of a broader range of IS/IT skills summarized by the researchers. For example, these researchers also provide data addressing the relative demand for a variety of "soft" skills (interpersonal, communication, problem-solving, project management, etc.), particular educational backgrounds, and experience with particular hardware platforms. The findings summarized in Tables 1- 4 have been extracted to illustrate the nature of the outcomes of most newspaper want ad studies and their potential shortcomings.

Table 1 suggests that Windows NT is in high demand among employers. Demand for UNIX experience and Windows also seems to be fairly strong among the employers whose newspaper ads were included in this investigation's sample. Unfortunately, these results are clouded by the fact that the demand for Windows NT is the collective demand for Windows NT Advanced Server as well as the client (desktop) operating system, Windows NT Workstation. Similarly, in Table 1,Windows 3.x (whose utilization is rapidly fading) is not cleanly broken out from Windows 95. Hence, while these results provide a general sense of the OS skills/competencies that employers in the Southeastern U.S. are looking for, their focus could be sharper. More importantly, the results do not clearly indicate whether any of these skills/competencies are in high demand, i.e., those for which employers would offer higher salaries.

TABLE 1
OPERATING SYSTEMS IDENTIFIED IN IS WANT ADS

Operating System	Percent
Windows NT	28.06
UNIX	23.93
Windows 3.x or 95	20.77
OS/400	16.78
Novell NetWare	12.65

The most commonly listed programming languages found in the sample of want ads analyzed by Case, Price, and Rogers (1997) are summarized in Table 2. These results could be interpreted in several ways. For example, they might indicate that COBOL is being widely used among firms in the Southeast US to develop new applications. They may also indicate a need to hire COBOL programmers to address Y2K problems, or that maintenance programmers are needed to maintain a sizable presence legacy systems coded in COBOL. In short, the reported data do not help IS educators pinpoint if the demand for COBOL programming experience among employers is driven by the need for new applications, Y2K problems, or a need for maintenance programmers. The results are also silent on the question of whether firms are willing to pay a premium for experienced COBOL programmers. These shortcomings limit the curricular value of the reported data.

Other limitations can be observed in Table 2. For example, C and RPG were mentioned more frequently in this sample of newspaper ads than Java and HTML. Does this imply that experienced C and RPG programmers command higher salaries than Java programmers and website developers? Should IS educators be building 21st century curricula around C and RPG rather than Java? Once again, the relative frequencies reported in this investigation may mask the skills/competencies that are truly in demand among employers.

Table 3 summarizes the most frequently mentioned application software mentioned in the ads analyzed in this particular study. This table suggests that experience with

IBM's Customer Information Control System (CICS) is still a marketable skill in major cities in the Southeastern U.S. Lotus Notes was the most frequently mentioned groupware product and Word and Excel were the two most commonly listed end-user applications mentioned in the job listings. Notably absent from Table 3 is experience with packages such as Baan, Peoplesoft and SAP. While Case et al. mention that SAP experience was specified in slightly more than two percent of their sample of want ads, trade periodicals consistently note that demand for SAP-experienced outstrips the supply. As a result, IS professionals with SAP proficiency often command high starting salaries.

Table 4 illustrates that Oracle was the most commonly mentioned database application mentioned in the sample of want ads collected by Case et al. (1997). SQL was the most commonly mentioned database application language; Access was the most commonly mentioned microcomputer-oriented database system. Few would argue with the importance of Oracle, SQL, and Access in today's computing environments, but again, the picture is far from clear for IS educators to derive a great deal of value from the findings. For example, how much experience with Oracle and/or SQL should students have? Is it sufficient to have students write SQL queries on an Oracle database, or should they be provided with in-depth experience with Designer 2000 or Developer 2000? What will set them apart in the job market? How much experience is needed to make students truly attractive to employers?

TABLE 2
PROGRAMMING LANGUAGES SPECIFIED IN IS WANT ADS

Programming Language	Percent
COBOL	35.76
Visual Basic	25.31
C++	25.17
C	16.78
RPG	13.20
JAVA	7.57
HTML	6.19

TABLE 3
APPLICATION SOFTWARE MENTIONED IN IS WANT ADS

Application Software	Percent
CICS	17.06
Lotus Notes	8.67
Word (Microsoft)	7.70
Excel (Microsoft)	7.43

TABLE 4
DATABASE TECHNOLOGIES MENTIONED IN IS WANT ADS

Database Technology	Percent
Oracle	19.39
SQL	17.74
DB2	13.76
Access (Microsoft)	13.62
Sybase	7.70
FoxPro	6.46
IMS	5.91

The weaknesses encountered in the data reported by Case, Price, and Rogers (1997) are endemic to most investigations that have summarized the contents of newspaper ads. While such studies may provide an overview of the range of IS/IT skills being sought by employers at a particular point in time (and sometimes in a limited geographic area), the examples mentioned above suggest that newspaper ads may present a limited view of the IS job market. In particular, investigations that content analyze newspaper want ads may fail to capture the importance and market value of emerging competencies and/or the skills/competencies that organizations are willing to pay a premium for.

The rare mention of known high-demand skills (such as experience with SAP, Peoplesoft, Baan, or Cisco internetworking technologies) in newspaper ads may be due to a collective perception among organizations that newspapers may be poor media for attracting individuals who possess cutting-edge or niche talents. Firms may utilize other media (including headhunters, IS trade publications, and on-line job listings) for recruiting/attracting individuals with high-demand niche expertise.

All of this suggests that newspaper ad investigations may have limited value to IS educators, especially those IS educators that are seeking to identify programming languages, operating systems, application software, and information technologies that can be used to illustrate course concepts and that are also in high-demand among employers.

Are there other/better sources than newspaper ads for identifying emerging and/or high-demand skills? Possibly so. Content analyzing the want ads that appear in major trade publications such as *Computerworld* may provide better insight than content analyzing newspaper ads. IS educators might also be better served by contacting headhunters that specialize in recruiting/placing IS/IT professionals. They are often aware of "what's hot and what's not" as well as the types of skills that organizations are paying big bucks (and high placement commissions) for. A third potentially useful approach may be to focus on the IS/IT training programs available in major IS/IT employment hubs. Such programs are typically developed in response to recognized employer needs for particular types of skills; the training firms are often reacting to supply-demand imbalances in the IS/IT labor market and have recognized the opportunity to capitalize on these imbalances. Often, trainers are able to draw trainees directly from employers who are desperate for particular IS/IT skills. They are also able to attract IS/IT professionals who recognize the supply/demand imbalances and hope to leverage the training to secure higher salaries and/or positions in firms who need employees with such training.

This third approach is the focus of the current investigation. Two studies were performed to assess the relative value of this approach for identifying high-demand IS skills/competencies. The first analyzed the content of ads for IS/IT training programs appearing in a Sunday edition of a newspaper in a major IS/IT employment hub: Atlanta, Georgia. The second study analyzed the content of on-line IS/IT training ads for the Atlanta job market found on the web on the same Sunday.

METHODOLOGY: NEWSPAPER TRAINING AD STUDY

The primary purpose of this investigation was to assess the correspondence between the types of training offered by IS/IT training firms and the patterns of industry needs observed in a 1997 study that content analyzed IS/IT want ads in major city newspapers in the Southeastern U.S. (Case, Price, and Rogers, 1997). In order to do this, the content of 28 IS/IT training ads appearing the Sunday, April 26, 1998 edition of the *Atlanta Constitution*. These 28 ads represented the total set of IS/IT training ads appearing in this newspaper on this particular Sunday.

The content analysis consisted of tallying the frequency that specific types of training were mentioned across the training ads published in the newspaper. The frequencies were converted to relative frequencies so that they could be compared to the relative frequencies (percentages) reported in the 1997 newspaper ad study.

The advertised IS/IT training programs were placed in the following categories (Operating Systems, Programming Languages, Applications, Database Technologies, Certifications, and Special Training). The results of this content analysis are summarized in the following tables and paragraphs.

RESULTS: NEWSPAPER TRAINING AD STUDY

Table 5 summarizes the types and relative frequency of operating system and network operating system training (distinct from that available through certification programs) mentioned in the 28 training ads. UNIX training is clearly the leader with Windows NT (the desktop version) being the second most frequently offered training program in the Atlanta area. Windows 95, NetWare 4.11, and Windows NT Server training were the only other types of operating systems training mentioned in the ads.

Table 6 summarizes the relative frequency of training in specific programming languages appearing in the training ads. Visual Basic training is the most widely available programming language training available from the training firms placing ads in this newspaper. C and C++ training are second in availability; HTML training is third with Java not far behind. SQL training was the only other programming language specified in these ads.

Table 7 summarizes the major application (development) software mentioned in the training ads. Powerbuilder is clearly the most popular type of application development tool training that is available among these training firms in the Atlanta area. Training in SAP R/3, Peoplesoft, and AutoCAD is also available. Two ads appearing in the newspaper offered training programs for Internet Explorer and Netscape. One ad offered training programs covering a wide range of word processing (Word, WordPerfect, Word Pro), spreadsheet (Lotus 1-2-3, Excel, Quattro Pro), and presentation graphics (Freelance Graphics, Powerpoint, Corel Presentations). Single ads for Eudora (e-mail) training, and Microsoft Outlook also appeared in the newspaper on this particular Sunday.

Table 8 summarizes the database-oriented training offered in the training ads. Needless to say, it is all Oracle or a specialized form of Oracle.

Table 9 summarizes the types of certification training programs offered by training firms in the Atlanta metropolitan area. Clearly training for Microsoft's MCSE certification is the most widely available; it is, in fact, the most frequently mentioned type of IS/IT training found in the ads. A+ certification training is second in availability, with CNE certification training third. As is apparent from Table 9, a variety of other certification training programs are also available in the Atlanta area including Microsoft Certified Office User, Cisco's CCIE, and Certified Help Desk Professional.

A variety of special training programs were also mentioned in the training ads appearing in this particular edition of the *Atlanta Constitution*. Included in this category is webmaster training, Internet Server training, Microsoft Exchange training. Other special training was available in web-page design, web-page publishing, TCP/IP, and NDS (Novell's directory services).

TABLE 5
OPERATING SYSTEMS IDENTIFIED IN IS/IT TRAINING ADS

Operating System	**Percent**
UNIX	21.43
Windows NT Workstation	14.29
Windows 95	7.14
Novell NetWare	7.14
Windows NT Server	3.57

TABLE 6
PROGRAMMING LANGUAGES SPECIFIED IN TRAINING ADS

Programming Language	**Percent**
Visual Basic	25.00
C	17.86
C++	17.86
HTML	14.29
Java	10.71
SQL	3.57

TABLE 7
APPLICATION SOFTWARE MENTIONED IN TRAINING ADS

Application Software	**Percent**
Powerbuilder	14.29
SAP R/3	3.57
Peoplesoft	3.57
AutoCAD	3.57

TABLE 8
DATABASE TECHNOLOGIES MENTIONED IN TRAINING ADS

Database Technology	**Percent**
Oracle	17.86
Oracle DBA	10.71
Designer 2000	7.14
Developer 2000	7.14
Oracle Financials	3.57

TABLE 9
CERTIFICATIONS MENTIONED IN IS/IT TRAINING ADS

Certification	Percent
MCSE	42.85
A+	21.43
CNE	17.86
MSOU	10.71
MCPS + Internet	7.14
Help Desk	7.14
Cisco CCIE	7.14
MCSD	3.57
MCPS	3.57
Bay Networks	3.57
Lotus Notes	3.57
CNA	3.57

DISCUSSION: NEWSPAPER TRAINING AD STUDY

As noted in the Introduction, the newspaper ads have been content analyzed by a number of investigators to gauge the demand for specific skills and abilities being sought by employers. Few investigators have actually attempted to verify their results through follow-up studies although most have recognized the importance of doing so. Todd, McKeen, and Gallupe's (1995) longitudinal study arguably does the best job of attempting to verify results across time, but their results are viewed by many IS educators as too general to provide specific guidance for curriculum modifications that respond to local or regional employer needs.

Training ads in the *Atlanta Constitution* were deliberately selected for this investigation because Atlanta was identified by Case, Price, and Rogers (1997) as being the major IS/IT job market in the Southeast; this was corroborated by the fact that the largest percentage of major city newspaper ads analyzed in their investigation came from this newspaper.

This content analysis of training ads provides tends to verify some of Case et al.'s findings, but tends to cast doubt on the curriculum-oriented value of many of the findings that they report. Similarity/verification is strongest in the area of operating systems. When Tables 1 and 5 are juxtaposed, it is clear seems clear that UNIX is one of the most important platforms in the Southeastern US, at least in Atlanta. Windows NT is also important. While their order reverses between the two studies, they are first and second in both. Windows, at least Windows 95, is third in both studies and the relative importance of NetWare is consistent across the two investigations. However, the importance of OS/400 (see Table 1) is not substantiated in the training ads, at least to the extent that no Atlanta area trainers were using the newspaper to advertise the availability of courses or training programs for this OS.

Additional verification of Case et al's findings seems to be found in the area of database technologies. As noted in Table 4, Oracle was the most commonly mentioned database in this particular newspaper ad study. When Atlanta area training ads are content analyzed (see Table 8), Oracle is the *only* type of database training being advertised. While this provides strong corroboration for Case et al's findings regarding this particular database, it raises doubt about the relative importance of the other database technologies found in their sample of newspaper ads.

Only partial verification of Case et al's findings regarding programming languages is provided by this content analysis of training ads. While the results of this study tend to confirm the marketability of Visual Basic, C, C++, Java, and HTML, there is no evidence that COBOL (Case et al's most frequently mentioned language) or RPG are perceived as having market value by the training firms in the Atlanta area. Neither COBOL nor RPG training is mentioned in this sample of training ads.

The percentage of training ads specifying the availability of Powerbuilder training (14.29%) is approximately the same as that found in Case et al's sample of newspaper ads (12.38%). While CICS was frequently mentioned in the newspaper ads, it escaped mention in the training ads. Experience with end-user products such, as Word and Excel, was mentioned more frequently in the newspaper want ads than in the training ads. As noted previously, only one training firm advertised in this edition of the newspaper that it offered training in end-user products.

The most striking difference between the results of this investigation and those reported by Case, Price, and Rogers (1997) was found for professional certifications. While Case et al. report that professional certifications such as Microsoft's MCSE and Novell's CNE "were rarely mentioned in the ads" (p. 148), they were liberally mentioned in this sample of training ads. MCSE training appears to be one of the most available types of IS/IT training in the Atlanta area. This finding is consistent with recent articles in trade publications (such as *Computerworld*) claiming that MCSE certification can mean a $7000 to $10,000 salary jump for individuals that obtain it. CNE certification also typically translates into a salary increase, but not as much as MCSE.

Table 9 suggests that a variety of other certifications also possess market value. Training programs for several Microsoft certifications (including MSOU, and MCPS + Internet) suggest that such certifications may be in sufficient demand in the Atlanta area for training firms to perceive it worth their while to offer training courses in these areas. Becoming a Certified Help Desk Professional and obtaining Cisco's CCIE also appears to have some value in the Atlanta IS/IT labor market. None of these certifications are even mentioned by Case et al. The findings of this investigation suggest that there must be some market value for these certifications in spite of their rare mention newspaper ads.

Noticeably absent from any of the newspaper training ads are courses designed to enhance "soft" skills (interpersonal, problem-solving, analytic, communication, project management, etc.). Also absent are general IS skills such as systems development, operations, and maintenance. Both soft skills and general IS skills were frequently mentioned in the newspaper want ads analyzed by Case, Price, and Rogers (1997).

The training ads analyzed in this investigation are decidedly focused on technical skill development/ enhancement. This pattern may also indicate a general bias among the training firms toward teaching easier-to-teach technical skills. The findings may indicate that training firms do not perceive a market for soft and general IS skill development courses. Since newspaper ad investigations consistently suggest that employers often seek new hires who possess a combination of technical and soft-side skills, the lack of attention to soft skills demonstrated by training firms may represent a skill-development niche that can be exploited by IS educators at colleges and universities.

METHODOLOGY: ON-LINE TRAINING ADS STUDY

In order to assess the generalizability of the previously discussed content analysis of newspaper training ads, a sample of training ads found on-line on the same day in the same major IS/IT employment hub was content analyzed. In this investigation, on-line training ads listed on the Technical Training page of a popular Atlanta IS/IT website (www.atlanta.computerjobs.com) on Sunday, April 26, 1998, were content analyzed.

The webpage summarizing the on-line training ads (n=44) was printed out. To facilitate comparison, the same categories as the ones developed for newspaper training ads were utilized. As was done for the newspaper training ads, the particular types of training courses falling into each of these categories were tallied and converted to relative frequencies (percentages). The major results of this investigation are summarized in Tables 10 through 13.

RESULTS: ON-LINE TRAINING ADS STUDY

A wider variety of training courses/programs were listed on-line than in the newspaper training ads. The convenience of web-publishing and the higher costs associated with placing ads in newspapers may account for the greater variety found on-line.

Greater emphasis on end-user training programs was found on-line than in the newspaper training ads. While training ads in the newspaper could be characterized as quite squarely focused on developing core IS/IT technical skills, the on-line ads offered a mixture of training encompassing both core IS/IT technical skills and end-user skills. In addition, unlike the newspaper training ads, the training programs advertised on-line mentioned courses focusing on "soft" skills and general IS job skills. Project management training was most common; it was mentioned in just over 10% of the ads. General courses on topics such as computer basics, software development, website creation, and networking fundamentals were also listed on-line but not in the newspaper ads.

Many of the training programs mentioned in on-line ads were less specific than those in the newspaper ads offering training. For example, some on-line advertisers offered training in "operating systems, spreadsheets, Macintosh, databases, word processing, and all major office suites". Others offered "Lotus authorized training", "Oracle products training" and "Microsoft networking". Many of these ads invited readers to visit their websites for more specific information. Because a primary of this investigation was to assess the generalizability of the results the newspaper training ad study, the non-specific on-line training ads were ignored (not classified) in this investigation.

Table 10 summarizes the major operating systems training mentioned in the on-line ads at this Atlanta website. The relative frequencies are quite consistent with those summarized in Table 5 for the training ads printed in the newspaper. UNIX and Windows NT are the platforms for which training is most widely available.

TABLE 10
OPERATING SYSTEMS SPECIFIED IN ON-LINE TRAINING ADS

Operating System	Percent
UNIX	25.00
Windows NT Workstation	15.91
Windows 95	11.36
NT Server	9.09

Table 11 summarizes the programming languages that are mentioned most frequently in the on-line training ads. When compared to Table 6, it is quite clear that there is a great deal of consistency among print and on-line ads for programming language training. Visual Basic training is among the most widely available types of training mentioned in both media. C++ training is also frequently advertised in both forums. Java training was observed to be advertised more frequently on-line than in the newspaper ads; SQL shows a similar pattern. Perl was mentioned in 6.8% of this sample of on-line training ads as was ActiveX. In general, web-oriented languages were specified more frequently in the on-line training ads than in newspaper training ads.

Other important types of training found in this analysis of on-line training ads are summarized in Table 13. Lotus Notes training was mentioned more frequently on-line than in newspaper training ads while Powerbuilder was advertised less frequently on-line. Both Access and Delphi training were only advertised on-line; they were not mentioned in newspaper training ads in Atlanta on this particular Sunday. Pagemaker was also only specified on-line.

TABLE 11
PROGRAMMING LANGUAGES SPECIFIED IN ON-LINE TRAINING ADS

Programming Language	Percent
Visual Basic	20.45
C++	20.45
Java	20.45
C	13.36
HTML	11.36
SQL	11.36

Table 12 summarizes the relative frequencies of certification training courses/programs advertised at this website. These percentages are generally consistent with those specified in the training ads in the newspaper (see Table 9); they tend to corroborate the perception created by the newspaper training ads that professional certifications are valued in the IS/IT job market. As noted previously, such findings seem to be at odds with the results of Case, Price, and Rogers (1997).

You may have noted that no attempt was made in this study to devise Tables comparable to Tables 7 and 8 for the analysis of newspaper training ads. This is because training programs for specific database technologies and application development tools were specified very infrequently in this sample of on-line ads. Although the newspaper training ads seem to confirm Case et al's finding that Oracle is the dominant database technology in the Southeastern US, the on-line training listings rarely reference Oracle or specific Oracle applications (e.g. Oracle Financials). The same pattern can be observed for the development tools summarized in Table 8. These were virtually non-existent in the on-line training ads—somewhat surprisingly, SAP was not mentioned at all.

TABLE 12
CERTIFICATIONS MENTIONED IN ON-LINE TRAINING ADS

Certification	Percent
MCSE	25.00
A+	22.72
CNE	15.91
CNA	9.09
MCPS + Internet	6.82
MCPS	6.82
MCSD	4.55
Help Desk	4.55

TABLE 13
OTHER IS/IT TRAINING FREQUENTLY SPECIFIED IN ON-LINE TRAINING ADS

Training type	Percent
Lotus Notes	11.36
Access	11.36
Delphi	6.82
SQL Server	6.82
Proxy Server	6.82
Pagemaker	6.82
Act!	6.82
Powerbuilder	4.55

GENERAL DISCUSSION

Like the content analysis of newspaper training ads, the analysis of on-line IS/IT training ads tends to support some of Case, Price, and Rogers (1997) findings and to cast doubt on others. Significant differences can be observed among the studies in the areas of programming languages and professional certifications. While Case et al found COBOL to be the most frequently mentioned language in their sample of IS/IT want ads in major cities in the Southeastern US, COBOL training is noticeably absent from both newspaper and on-line training ads. Also, although Case et al found professional certifications rarely mentioned in their sample of want ads, professional certification training is arguably the most widely advertised type of IS/IT training offered by training firms in the Atlanta area. Such inconsistencies may contribute to prolonged debates among IS educators about the place of COBOL in IS curricula and whether courses should be restructured to move students toward professional certifications.

The findings suggest that a wider array of IS/IT training may be advertised on-line than in newspapers, at least this seems to be the case in Atlanta. In general, training programs advertised in the newspaper are more consistently oriented toward core IS/IT skills/competencies than are those advertised on-line. Similar to newspaper training ads, on-line training ads generally have a strong technical flavor, however, the wider range of training and the inclusion of end-user and a few "soft" skills training programs slightly dulls the technical edge of on-line training ads. The wider range of training found on-line tends to make the results of the second study more consistent the results reported by Case et al.

The findings in these two analyzes of training ads tends to confirm the results of other studies focusing on the Georgia and Southeast U.S. For example, McLean and Schneberger (1997), report that UNIX experience is highly valued in the IS/IT job market in Georgia; Visual Basic, C and C++ are also reported by these researchers to be in high-demand among employers in Georgia. The findings of these two training ad investigations do not contradict McLean and Schneberger's claims.

The findings of these investigations suggest that HTML and Java appear to be growing in value. The newspaper training ad study seems to provide further evidence that Oracle experience is important among employers in the Atlanta area.

While not mentioned in the newspaper training ads, soft skills training programs were available from a few the training firms advertising on-line. Case, Price, and Rogers (1997) found them to be mentioned frequently in their sample of IS/IT want ads. McLean and Schneberger (1997) and Jacobson and Armstrong (1996) found in the same pattern in their analyses of IS/IT newspaper want ads. This consistency across the newspaper ad studies offers strong evidence that such skills are highly valued by many employers. Since training programs for such skills seem to be overlooked by most training firms, soft skill development may represent a niche training area that college and universities can exploit.

Limitations of this Investigation

It is important to note that this study focused on training IS/IT advertisements for a single Southeastern US city (Atlanta) in April of 1998. Case, Price, and Rogers (1997) cast a wider net by capturing data from most of the major cities and IS/IT employment hubs in the Southeastern US. If this study had attempted to analyze training ads from each of the cities included in Case et al's investigation, more similarities and fewer points of departure among the findings might have been observed. The fact that this study only captured data at one point in time (and at a time different from the Case et al study) is also a limitation. Differences observed across the studies findings may reflect the changing popularity of particular languages or technologies.

Another potential limitation may reside in its assumption that firms offering training programs are attuned to employer needs and the relative value of particular skills in the Atlanta IS/IT job market. While it seems reasonable to assume that trainers would not offer training for non-valuable skills/competencies, we should not lose sight of the fact that training ads are marketing tools for training firms. They are created to "sell" the importance of the skill in order to lure buyers (trainees) to take advantage of their services (training programs). Like other effective marketers, training firms have a vested interested in selling their product even if it isn't exactly what the market needs. Hence, there may be more reason to trust what employers say they need in the want ads that they personally place in newspapers than to trust the skills being "sold" by training firms.

Curricular Implications

When the results of Case, Price, and Rogers' (1997) newspaper want ads study are juxtaposed with those of the current investigation, no clear curriculum path is indicated for programming languages. COBOL remains a question mark as do the emerging web-oriented languages such as Java. Visual Basic and C++ seems to be pretty safe bets at this point in time in spite of some prognosticators who predict that these languages will be displaced by Java within three to five years. There is strong evidence across the studies that using UNIX to illustrate course concepts will also provide students with marketable skills.

Perhaps the most significant curricular implication of this investigation is the potential soft skill training niche that universities and colleges are positioned to exploit. Such institutions have traditionally been focused on helping students fine-tune their communication and interpersonal skills. Thus, they seem to be well-positioned to leverage their traditional strengths to provide students with valuable labor market skills (the soft skills) that training firms seem to be ignoring in favor of technical skill development.

It is common knowledge that the need for particular technical skills will continue to change in the years ahead and that their half-lives will continue to shorten. The soft skills that colleges and universities are well-positioned to cultivate among their students are likely to be much more enduring. Some of these soft skills will be the cornerstones of the foundation needed for lifelong learning.

To directly compete with IS/IT training firms, colleges and universities will have to find ways to incorporate high-demand technical skills/competency development within their curricula. Since such skills/competencies change often and rapidly, universities will have to be committed to ongoing (and potentially costly) faculty training and development in high-demand languages, application programs, operating systems, and IT technologies. Faculty members will have to have up-to-date skills/competencies if they are going to help their students develop the same. Ironically, in the near-term, such faculty training and development is likely to be provided by IS/IT training firms.

In Georgia, some universities and technical schools are restructuring their curricular to include training toward professional certifications (such as the MCSE) within their programs of study. Such restructuring is part of Georgia's ICAPP program which is designed to enable the University System of Georgia to satisfy more of the state's burgeoning demand for IS/IT employees with state-of-the art skills and competencies. This attempt to provide degree-seeking students with the types of technical training traditionally available from training firms seems to be one university system's attempt to compete more directly with training firms.

Future Research

An obvious follow-up to this investigation is to expand it to incorporate training program data from all the cities in the Southeastern US that were included in Case, Price, and Rogers (1997) If a similar pattern of findings was found, there would be strong evidence that these findings reflect the general types of technical training available in the major IS/IT employment hubs in the Southeastern U.S.

Another approach would be to survey and/or interview headhunters and IS placement firms to assess their views of the skill sets that are most in demand among employers. Such an investigation would help to address the question of whether training firms are attuned to the real needs of the market. It would also provide another test of the extent to which newspaper want ads accurately reflect high-demand IS/IT skills. Other investigations might survey the graduates of IS programs concerning the types of training they have recently received and the types of training they want to pursue next. The consistency among newspaper and on-line IS/IT want ads should also be assessed.

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THE CREATION OF COMMON CIS FOUNDATION COURSE SEQUENCES FOR GRADUATE ENTRY

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The School of Computer and Information Sciences (CIS) at the University of South Alabama has responsibilities for all undergraduate and graduate degree programs in the computing sciences. These include BS and MS degrees in both Information Systems (IS) and Computer Science (CS). Both of the MS degree programs have experienced significant growth over the last few years. This growth has strained the already limited resources of the School of CIS and is considerably compounded by the demographics of the entering graduate student population. The vast majority of new graduate students have undergraduate degrees in non-CIS areas. This has necessitated an extended period of time in which these entering graduate students are required to take numerous undergraduate foundation courses. Typically, due to the prerequisite structure, it has taken a full two years to prepare these students for graduate work. The graduate program typically takes four semesters to complete once all undergraduate prerequisites are satisfied. Elapsed time can be shortened by attending summer sessions but the total time in the program for these students is often four years. To address the problems, drawing from our recent successes with a cognitive-based approach in the undergraduate program, an accelerated sequence of study has been created that allows entry into the graduate courses after only one year. Due to resource constraints it was also necessary to accomplish this foundation in a common mode for both Computer Science and Information Systems students. This paper presents the experiences and observations of the authors while developing and implementing these course sequences over the past year.

INTRODUCTION

Several of CIS faculty at the University of South Alabama have been active in curriculum development efforts for the past decade [DPMA 1991], [Daigle 1997], [Daigle 1998], [Doran 1993], [Doran 1994], [Doran 1995], [Doran 1997], [Longenecker 1997]. A significant amount of the effort has been directed to providing students with problem solving (using Polya [1957] as a guide), programming and algorithmic development skills in support of CS and IS national curricula models. A supporting theme of a cognitive-based approach to learning was integrated throughout the learning experience to provide a framework to measure achievement of curricular goals [Doran 1995], [Langan 1996]. The work of Bloom [1956] provides a framework to document the process. Bloom describes six levels of learning that occurs. The levels are: Level 1 - Factual, Level 2 - Use, Level 3 - Application, Level 4 - Analysis, Level 5 - Synthesis, and Level 6 - Evaluation. At each level a skill set can be identified and activities defined to demonstrate concept mastery. Over the last several years, the School had evolved to a shared CS and IS freshman and sophomore undergraduate curriculum. This core is consistent with the CS and IS curricula models and is based upon our cognitive approach.

The CIS graduate program at the University of South Alabama attracts students from our undergraduate CS or IS programs but the majority come from other disciplines. In the past, the foundation requirements for the non-CIS students entering the graduate program were substantially different for the CS and IS programs. Non-CIS students choosing a specialization in CS were required to complete undergraduate computer science courses in introductory algorithmic design and program development, computer organization, data and file structures, and programming language theory. In addition supporting courses in mathematics and statistics were required. Non-CIS students choosing a specialization in IS were required to complete undergraduate computer science courses in introductory algorithmic design and program development and an applications development course using COBOL. Supporting courses in accounting, finance, mathematics, and statistics were also required. IS specialization students were not required to complete the undergraduate computer organization course and the data and file structures courses because there were corresponding graduate level courses that covered the material in an accelerated mode. Advising of CIS students focused on deficiencies in their undergraduate CIS course work that might affect performance in graduate CIS courses.

Over time, several problems surfaced with the approach of using undergraduate CIS courses for these graduate students. In the succeeding sections we describe these problems, discuss our approach to resolving these problems, and share observations from the initial implementation.

PROBLEMS

The problems that arose as a consequence of using the undergraduate CIS courses for graduate prerequisites centered on three critical issues: (1) Time to complete the MS, (2) Prerequisite structure or knowledge synchronization as manifest with student maturity in the discipline and (3) Faculty resources.

Time and Synchronization: The initial complaints voiced by graduate students were focused on time to complete the MS degree. Requiring students to enroll in graduate CIS courses until all prerequisite and supporting courses were completed resulted in minimally three-and-one-half years to complete the IS specialization and four years to complete the CS specialization. Directly related to time was cost to complete the program: because the courses were designed for undergraduates, concepts were spread over a longer time frame to support undergraduate discipline maturation. This translated into more courses and greater costs for the graduate students.

A significant number of the graduate students were international. This added a constraint of minimum enrollment hours that compounded the problem. In an initial attempt to correct the completion time problem was to permit concurrent enrollment in specific prerequisite CIS undergraduate and certain CIS graduate courses. The faculty felt that this was a threat to the quality of the material that could be presented in the graduate courses affected.. While a student might be intellectually qualified, a broader and more complete knowledge correlation occurs when all prerequisites preceded the graduate course. Consider, for example, the Systems Analysis and Design sequence in the IS graduate program. Students often are intellectually qualified to take the graduate sequence but still have problems. They lack the technical background obtained from programming and data and file structures courses. They do not possess the analytical tools provided by mathematics and statistics. They do not have experience or the context given by the supporting business courses. Because of these deficiencies the student will not be prepared to correlate theory, technical, analytical, and context components for a broader, richer, and more complete understanding of the sequence.

Student Maturity

Complaints regarding differences in maturity level between graduate and undergraduates were submitted by graduate and undergraduate students as well as by faculty who taught undergraduate courses used as prerequisite for the graduate courses. Because of our prior investigation and successes, a cognitive-based approach was used in the beginning CIS undergraduate courses. This approach focuses on reflective problem-solving and algorithmic development according to clearly defined objectives written according to Bloom's taxonomy of learning. The material is presented in an integrated classroom/laboratory.. This approach facilitates maturation in the undergraduate discipline. Many graduate students possessed intellectual maturity to proceed at a much faster pace than was being employed in the undergraduate courses. Tension existed between graduate students who wanted to move through the material faster and faculty who were committed to slower pace for undergraduates. This resulted in frustration for many graduate students and confusion for many undergraduates. In addition to the pace complaint, many students complained that the expectations of the undergraduate courses were much below the levels expected in subsequent graduate courses. Some success was experienced by use of bridge courses with higher expectations and larger projects [Denton 1996], [Doran 1996], however, the bridge-course approach only added to the number of foundation courses needed to be completed before entry into the graduate program.

Computing Literacy and Faculty Resources

It is also important to observe that as the computing discipline has matured there has been a migration of material from graduate education into undergraduate programs. In our program several courses taught at the graduate level for IS students that were now completely replicated at the undergraduate level [Longenecker 1997]. The consequence of this migration is a higher expectation of entry-level computing literacy resulting in a higher expectation of exit-level computing literacy of exiting graduate students. This had a significant impact on a self-imposed constraint: to minimize the need for new resources: faculty, hardware, and software.

SOLUTION

To help correct the situation we looked at some of our recent successes. Over the past several years, with funding from the National Science Foundation, the undergraduate courses have been redesigned using a cognitive based approach with integrated structured laboratories [Doran 1995], [Langan 1996]. This approach has likewise been applied to selected graduate courses [Doran 1994].

The solution has been to create an accelerated sequence of study that could be completed in one year to allow a quicker entry into the graduate courses. Our understanding of entry-level computing literacy as a consequence computing discipline maturity coupled with our experiences with the shared-CS and IS freshman and sophomore undergraduate curriculum gave us confidence to implement the foundation in a common mode for both CS and IS students.

The foundation undergraduate courses that were required fell into three categories:

I. Common to both the IS and CS programs:
   Algorithmic design and program development
   Data and file structures
   Visual/Event Driven Applications Development
   Networks and Communications
   Computer organization

II. Courses for each specific area
   Information Systems: Application Development in COBOL
   Computer Science: Programming Language Theory

III. Supporting courses for IS from Business management and for CS from Mathematics

In developing these new courses extensive use was made of the materials developed under the NSF grant [Doran 1997]. The central focus was on the development of problem solving skills [Doran 1993]. A supporting theme of a cognitive-based approach to learning was integrated throughout the learning experience to provide a framework to measure the achievement of curricular goals [Doran 1995]. Using these ideas a comprehensive set of materials were developed. The courses are now sufficiently stable so different faculty members can teach them in a consistent manner.

These materials proved to be critical in developing the first courses in the accelerated graduate foundation sequence. Material is paced approximately 50% faster than in the corresponding undergraduate courses. Without the existing structured materials, implementing these new sequences would be very difficult.

Two sequences with a total of five 3-semester hour courses have been developed. The first sequence focused on software development including algorithmic design and program development in a high-level language followed by a course in data/file structures. A final course in this sequence addressed application development in a visual/event driven setting. The other sequence addressed issues associated with computer hardware, organization, operating systems and communications networks.

There was one additional course specific to each area: IS students were required to take a course in application development using COBOL and CS students were required to take a course in Programming Language Theory. The supporting areas in business or mathematics were often satisfied in previous undergraduate degree work. Most of the typical IS students satisfied the business requirements since they often came out of business programs; while most of the CS students often had engineering degree which satisfied the mathematics requirements.

REFLECTIONS ON THE INITIAL IMPLEMENTATION

The program has been in place for one year. We have achieved the dual goals of accelerating the entry into the regular graduate program while maintaining a commonality between the IS and CS programs. There are several observations, which can be made:

1) The use of the prior materials made the faster pace more achievable.

2) Because there is a graduate peer environment and because everyone started at about the same skill level, students are more likely to participate in in-class discussions. The stigma of being perceived as a "dumb" or "egotistical" graduate student is less likely to occur in this peer-to-peer environment. Thus the dichotomy of maturity levels of graduate versus undergraduate is alleviated.

3) Graduate students who can handle the faster pace can complete the prerequisites and graduate courses in three or fewer years. Thus time to complete the degree and cost for the degree are reduced.

4) The initial semester experience in graduate courses with students who have successfully completed all prerequisites has been positive. Students appear to be more at ease (they have spent a year with each other already) with contributing to class discussions, they have more confidence in their individual skills (they have shared project implementation experiences) than their predecessors. They also appear to be equipped to bring their computing competency, analytical tools, and context together to bear on the theoretical and implementation components of the graduate program.

5) The sequences have permitted a significant upgrade to the graduate curricula.

6) Advising is simpler. For those with no computing experience, the CIS graduate foundation is prescribed; for those with some computing experience, the foundation courses or undergraduate courses are prescribed to remove any deficiencies.

7) The quality of the curricula can be monitored more easily.

8) The foundation courses provide elective options for students in other graduate programs. For those who may want a programming emphasis: Algorithmic design and program development, Data and file structures and Visual/Event Driven Applications Development can be used. For those who may want hardware oriented emphasis: Networks and Communications and Computer organization can be used.

9) This faster pace is not for all students and a screening process needs to be created. The undergraduate route is available for those graduate students for whom a slower pace is desirable.

The initial implementation experience has resulted in abandoning the special course for IS and CS approach and adopting a common sequence approach for both CS and IS. Initially, the IS applications development course using COBOL was taught in a database-project approach [Daigle, 1997] on the quarter system. As a consequence of teaching the Visual/Event Driven Applications Development course, it became apparent that the objectives of the two courses could be combined for a single course offering on the semester system. The Programming Language Theory course will include a COBOL component to accommodate an IS need for some familiarity with COBOL.

The foundation undergraduate courses that are required now fall into two categories:

Common to both the IS and CS programs:
  Algorithmic design and program development
  Data and file structures
  Visual/Event Driven Applications Development
  Networks and Communications
  Computer organization
  Programming Language Theory

Supporting courses for IS from Business management and for CS from Mathematics

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INFORMATION TECHNOLOGY MANAGEMENT FOR RISING EXECUTIVES: MBA CURRICULUMS AT AACSB ACCREDITED SCHOOLS

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According to Peter Keen (1991), every business manager must be able to manage information technology. Since information technology amounts to half of the typical U.S. firm's capital expenditures, a key concern is how AACSB-accredited MBA programs are educating their rising executives in technology management. This study details a content analysis of forty-five syllabi used in the required information technology course in AACSB accredited MBA programs. Topics are compared to critical issues in technology management identified by both CEOs and CIOs. The study may be used by accredited schools and those seeking accreditation to benchmark their own required MBA information technology course.

INTRODUCTION

Changes in information technology (IT) during the past decade have caused changes in IT management, in marketable IT skills, and in MIS curriculums. During this decade, business organizations have become increasingly dependant upon information technology as an integral part of every functional area. "Half of the CEOs and boards of directors of the world's largest companies now consider information technology when they develop corporate strategies, according to a survey of 100 such executives by management consulting firm A.T. Kearney" (Scheier, 1997, 86). According to a vice president at this consulting firm, "Technology is considered too critical to success to be left solely in the hands of technologists" (Scheier, 1997, 86). Executives now look to technology not just to reduce cost, but to drive growth (Stedman, 1997). The 500 U.S. companies with the highest revenue spend more than $100 billion on information technology (Alter, 1997, 74). Therefore, effective technology management has become a critical skill for the general business manager. According to Deloitte & Touche's Survey of American Business Leaders, including 150 senior executives, "information systems is an investment, say 83% of respondents, rather than a cost to be managed" (Alter, 1996, 90). Ninety-three percent of these executives have PCs on their desks (Alter, 1996, 90).

Knowing how to solve problems and capture opportunities using appropriate IT are critical success factors for any MBA graduate; yet,an information technology or MIS course is not part of the required core at many AACSB accredited schools. Further, MIS is a hybrid discipline whose curriculum continues to lack the standardization of many older business disciplines. This study examines the required MIS or information technology management course in sixteen AACSB accredited MBA programs. A major research concern is whether these required courses share discernible common attributes. Other research questions are as follows:

- What is the course called?
- What are the texts or required readings?
- What are the common assessment methods and weights?
- What percent of the total evaluation is linked to teamwork?
- What are the common topics covered?
- How do these topics compare to those critical issues identified by CIOs and CEOs?

- What improvements can be made in the required MIS MBA course based on lessons learned from this analysis?

METHODOLOGY

A combination of phone calls, e-mails, faxes, and web sites was used to obtain syllabi. First, we used a combination of phone calls and follow-up e-mails to solicit syllabi from twelve selected schools. We received three (25% response rate) syllabi from this first effort. Then, we used the survey strategy recommended by Professor Max Burns from Georgia Southern University (1998). We sent a fax to seventy-three AACSB (1997-98) accredited schools requesting a copy of the syllabus for the required MIS or information technology management course in their MBA program. Three working days later, a second fax labelled "second request" was sent to all non-responding schools. We received twenty-six responses (36% response rate) and were able to use thirteen syllabi. At this point, a pilot study was conducted (Stephens, 1998). Subsequently, the IS World web site solicited MIS syllabi and we used twelve syllabi posted to this site. For the forty-seven remaining accredited programs, we sent a fax to each Dean's office asking for the name of the professor responsible for this course. We then e-mailed each professor and requested a syllabus. We received thirteen complete syllabi (28% response rate) from these personal e-mails. Finally, we requested syllabi from a listserve and received four syllabi not already available to us. We did receive responses from some schools indicating that no such course was required. Some responses indicated that an integrated curriculum made the elements of analysis for our study impossible to identify. We indicated in our communications that we would share the results of our study. Schools participating in our study are listed alphabetically in Appendix A.

The following elements were analyzed on each of the forty-five syllabi: course name, texts or required readings, assessment methods and weights, the proportion of assessment linked to team work, and course topics. Topics were then compared to recent CIO and CEO surveys on critical IT management issues.

Course Name

The required course lacked a common name (Appendix A). A total of thirty different names were used by the forty-five schools for the required course. "Management Information Systems" was used by nine schools and "Introduction to Management Information Systems," by three for a total of twelve schools using the MIS title for the course. "Information Systems" was used by four schools.

Required Readings and Texts

Just as course names lack standardization, so did texts used (Appendix B). Applegate, McFarlan, and McKenney's *Corporate Information Systems Management: Texts and Cases* was the most frequently used text with eight schools requiring this text. Alter's *Information Systems* was used by four schools and Cash, Eccles, Nohria, and Nolan's *Building the Information Age Organization* was used by three schools. Appendix B provides an alphabetical listing by frequency of all texts used by the forty-five schools. Reading packets were commonly required and some schools required only these packets. Some schools required more than one text.

Assessment Methods and Weights

The following assessment methods were used by these schools: exams, quizzes, case study analyses, research papers or topic studies, computer-based projects, class participation, reports on reading of articles and/or books, and other daily assignments. One school used the journal method extensively. This exception was included under reports.

All but five of the schools used examinations with the average weight being 46% of the course grade (Appendix C). Weights ranged from 20% to 100%. The 84% of the courses using exams averaged two exams per term. The maximum number given was four and the minimum was one. The second most frequently used assessment method was class participation with twenty-seven of the courses or 60% using participation for an average of 18% of the course grade. The range was from 5% to 50%. Examinations and class participation, then, accounted for two-thirds (64%) of course assessment on average. Only seven courses used quizzes as an assessment component. Slightly more than half of the professors (53%) used case studies and on average, weighted case study work at 23% of the course grade. Research papers or topic studies were also employed by slightly more than half the professors (51%) with the average weight being 23% as well. Thirteen professors of the 44 reporting grade weights (30%) used both case studies and a paper in the MBA course. Computer-based projects were used for assessment in 42% of the schools as were graded assignments. Reports on journal articles and books or keeping a weekly journal based on class and readings was a requirement in only six courses. The assessments methods ranked by frequency of use were as follows:

- Exams (typically 2 at about 20-25% each)
- Class participation
- Case studies
- Research paper or topic study
- Computer-based project and Assignments (tie)
- Quizzes
- Reports (books, articles, create own journal)

Not all syllabi specified the requirements for class participation, case study analysis and presentation, research paper, projects, and assignments. However, some syllabi specified each in great detail. One syllabus specified the method for scoring participation on a 1 to 5 scale. One syllabus offered a special assignment for those who would rather not speak out in class. Interestingly, none of the courses required students to write case studies.

Teamwork Component

Over half the courses (55%) required teamwork; on average, weighted team assignments accounted for 33% of the course grade (Appendix D). Computer-based projects were the most common team assignment (12 schools), followed by cases (10) and topic studies or research papers (9). Teamwork on cases typically contributed 25% of the course grade; research papers or topic studies completed as a team, 19%; computer-based projects, 25%. Two schools had team assignments and one school used teams for article reports/presentations.

Topic Categories

Topics were taken from the listings available on the syllabi. Therefore, a syllabus which provided a more detailed listing is better represented than one which provided major topics only. While actual course content may have covered a topic, only topics explicitly listed in the topics list or course schedule were used for the analysis. Some of the more detailed topics overlap with broader topics. For example, collaberative work overlaps with decision support which includes group support. Acquisition/implementation issues are a subset of the broader systems development process topic. Client/server may not have been listed in some courses but discussed under the broader topic of IT architecture.

As a precise indicator of course content, the topic analysis is flawed; however, the analysis does provide an overview of course content. Fifty percent or more of these courses listed the following seven topics (Appendix E):

1.	strategic applications of IT
2.	information age organization: IT design and management
3.	systems development process (planning, building, managing)
4.	IT architecture and infrastructure
5.	telecommunications fundamentals
6.	IT enabled process redesign
7.	types of systems and evolution of IT (TPS, DSS, GDSS, EIS, ES, etc.)

Almost fifty percent included electronic commerce and database fundamentals as a main topic. Other major topics listed (Appendix E) were:

- decision support
- interorganizational systems/strategic alliances
- fundamentals of HW and SW.

Twenty-five percent of responding professors listed security/privacy, information resource management, ethical issues, and thehuman side of technology/the individual and IT as separate topics.

Comparison of Topics to CIO/CEO Issues

CEOs and IT executives or CIOs surveyed placed importance on incorporating IT in strategic planning (Scheier, 1997; Schurr, 1997). Senior executives are also investing heavily in IT infrastructure and using this infrastructure to compete globally (Alter, 1996). These two concerns are clearly reflected in the number one topic: strategic applications of IT. Another executive concern, using IT to grow sales (Stedman, 1997), may be embedded in strategic applications but is clearly shown in the attention to electronic commerce by 21 schools. Global systems appears as a specific topic on 11 syllabi. IT infrastructure tied for third as the most frequently listed topic (27 schools).

A Deloitte & Touche survey of 431 North American CIOs (1996) identified the following issues as key ones for CIOs:

- Client/server architecture and networking: the percentage of firms using client/server is now greater than those not and expenditures are expected to grow. Visual Basic was "identified most often by CIOs as an important client development tool." However, mainframe purchases and upgrades exceeded all other platforms (http://www.dttus.com/publications/cio/key.htm, 1996,1).

- Business process reengineering or redesign
- Replacing legacy systems
- Outsourcing (particularly the disaster recovery function)
- Integrating domestic and international systems within the organization or global systems
- Electronic commerce
- Purchasing commercial off-the-shelf software

The key issues identified by CIOs are, for the most part, represented in the syllabi studied. The shift in IT architecture and infrastructure appears as a major topic in a majority of syllabi (Appendix E). Related topics include interorganizational systems, telecommunications and database fundamentals, data warehousing, and of course, the specific topic client/server. Business process redesign is a major topic in half the syllabi, with electronic commerce appearing on 21 syllabi. However, outsourcing, replacing legacy systems, and integrating domestic and international systems -- all specified as key issues in the Deloitte and Touche survey -- appear infrequently or not at all on the syllabi.

According to CIOs in another survey, the most important issue was building a responsive IT infrastructure (Brancheau, Janz, Wetherbe, 1996). This issue was one of the top three topics on MBA syllabi. Other issues identified in order of importance were as follows:

1. IT infrastructure
2. Business process redesign (reengineering)
3. Distributed systems
4. Information architecture
5. Communications network
6. Software development
7. Information resource management
8. IS human resources
9. Aligning IS with the enterprise
10. IS strategic planning
11. Collaberative systems
12. Measuring IS performance
13. IS role/value to organization
14. Organizational learning
15. Legacy applications
16. End user computing
17. IS for competitive advantage
18. System integration
19. Electronic data interchange (EDI)
20. Outsourcing

Comparing this list of important issues to the topic analysis (Appendix E), the topics not well represented appear to be IS human resources, measuring IS performance, IS role/value to the organization, legacy applications, end user computing, and system integration.

Potential Improvements

Considering the topics covered and the critical issues according to senior executives, the course might best be called the "Management of Information Technology." Since strategic use of IT requires attention to multiple perspectives, teamwork in the MBA course seems appropriate for a significant portion of the course. For computer-based projects, Visual Basic might be an excellent choice for some project teams. Textbooks which include strategic applications but also include good coverage of client/server architecture, evaluation and integration of purchased software, global systems integration and support, electronic commerce, and outsourcing would be helpful. Clearly, the courses studied are very different, suggesting the possible need for two courses:

(1) Foundations in Information Technology: technology fundamentals and architectures, computer-based projects
(2) Management of Information Technology: strategic applications, organizational and process redesign with IT, with case studies and topic studies.

Educating future executives in information technology appears to have a positive impact on the performance of an organization. One CEO survey indicated that CEOs and other top managers who are comfortable with technology initiate one third of the IT projects in their organizations while those who are not initiate fewer than 15% (Caldwell, 1997, 100).

Further Research

Some questions not pursued are, "How does the mission of the business school affect the IT course?" Is the course taught differently at universities with a "research" mission than at universities with a "teaching" mission? A grouping of topics into topic clusters would improve the topic analysis. Further, after sharing work thus far, the authors hope to encourage other professors to share syllabi and have an even larger number of syllabi available for review. Finally, on the basis of the content analysis, a survey could be formulated which might more accurately assess course content and employ a larger sample size.

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APPENDIX A
PARTICIPATING COLLEGES AND UNIVERSITIES

School	**Course Name**	**Syllabus Date**
Appalachian State University	Information Systems for Planning and Control	Summer 1998
Arizona State University West	Introduction to MIS	Fall 1997
Auburn University	Introduction to the Management of Information Technology	Winter 1998
Ball State University	Management Information Systems	not given
Bentley College	Information Technology in the Business Environment	Spring 1998
California State University, San Marcos	Management Decision Making and Analysis (MIS)	Summer 1996
Clemson University	Information System Design and Implementation	Fall 1997
Cloud State University	Management Information Systems	Spring 1998
DePaul University	Management of Information Technology	Winter 1997

School	Course Name	Syllabus Date
East Carolina University	no name given on syllabus	Spring 1998
Emory University	Information Technology and Decision Support	Spring 1996
Florida Atlantic University	Introduction to Management Information Systems	Fall 1998
Florida International University	Organizational Information Systems	Spring 1998
Georgia Southern University	Fundamentals of Computer Information Systems	Spring 1996
Georgia College and State University	Information Resource Management	Fall 1998
James Madison University	Management Information Systems	Spring 1997
Michigan State University	Enterprise Information Systems	Spring 1998
Mississippi State University	Management Information Systems	Summer 1997
New York University	IT and Organizations	Fall 1997
Northeastern University	Information Resource Management	Fall 1998
Southern Methodist University	Managing Information Technology	Fall 1997
Texas Christian University	Managing with Information Technology	Spring 1998
University of North Florida	Management of Information Technology	Fall 1998
University of Georgia	Information Systems Management	Fall 1998
University of Baltimore	Information Systems and Technology	Spring 1998
University of Cincinnati	Information Systems for Managers	Fall 1995
University of Maryland at College Park	Strategic Information Systems	Fall 1996
University of Missouri	Management Information Systems	Fall 1997
University of Kentucky, Lexington	Management of Information Resources	Summer 1998
University of Missouri, Kansas City	Management Information Systems	Fall 1998
University of Missouri, St. Louis	Management Information Systems	Fall 1998
University of West Georgia	Strategic Management of Information Technology	Spring 1996
University of Alabama at Birmingham	Management Information Systems	Fall 1996
University of Alabama in Huntsville	Seminar on the Management of Information Technology	Spring 1998
University of Colorado at Colorado Springs	Information Systems Concepts	Spring 1998

School	Course Name	Syllabus Date
University of Houston	Information Systems	Spring 1998
University of California, Los Angeles	Information Systems	Spring 1998
University of South Carolina	Information Systems	Fall 1997
University of Utah	Introduction to Information Systems	Fall 1997
University of Kansas	Managerial Information Systems	Spring 1997
University of New Mexico	Introduction to MIS	Spring 1997
University of Pittsburg	Information Systems	Spring 1997
Western Carolina University	Decision Support Systems	Spring 1998
Wright State University	Information, Technology, and Organizations	Fall 1997

APPENDIX B
TEXTBOOKS

Total	Textbook	Schools
8	Applegate, McFarlan & McKenney. Corporate Information Systems Management: Texts and Cases, 4th ed. Irwin, 1996	2,4,24,32,35, 38,39,41
4	Alter, Information Systems, 2nd ed	15, 29,44,21
3	Cash, Eccles, Nohria & Nolan. Building the Information Age Organization, Control and Information Technologies	5,12,17,
2	Laudon and Laudon. Essentials of Management Information Systems: Organization and Technology, 1997.	8,11
2	Lucas. Information Technology for Management. McGraw-Hill, 1997.	13,24
2	Martin, Hoffer, et al. Managing Information Technology: What Managers Need to Know, 2nd ed. MacMillan.	3,26
2	McKeown and Watson, Metamorphosis.	15,27
2	Morgan, Application Cases in MIS, 2nd ed., 1996.	4,36
2	O'Brien. Introduction to IS, 8th ed. Irwin	7,46
2	Stair and Reynolds. Prinicples of Information Systems: A Managerial Approach. Course Technology, 1998.	6,40
2	Turban, McLean, Wetherbe. IT for Management, 1996 and 1999.	22,33

Total	Textbook	Schools
1	Cats-Baril and Thompson, Information Technology and Management, Irwin, 1997.	10
1	Cook. Building Enterprise Information Architectures. Prentice Hall.	
1	Hansen and Hansen, Database Management and Design, Prentice Hall, 1996.	9
1	Harvard Business School Casebook, Managing in an Information Age	43
1	Hatfield. Developing PowerBuilder 5 Applications. Sams Publishing, 1996.	9
1	Kallman and Grillo. Ethical Decision Making and IT. McGraw-Hill, 1996.	30
1	Laudon and Laudon. Management Information Systems, 1996.	22
1	McNurlin and Sprague. IS Management in Practice. Prentice Hall.	36
1	Parker and Case. MIS, 1989	28
1	Post and Anderson. MIS. Irwin, 1997	30
1	Reynolds. IS for Managers, 1995	20
1	Siegel. Teach Yourself Access 97. MIS Press	43
1	Burgelman, Maidique, Wheelwright, Strategic Management of Technology and Innovation. Irwin, 1997.	47
1	Applegate. Managing in an Information Age. 1996	25
1	Wall Street Journal	43
1	Willicocks, Feeny, Islei. Managing IT as a Strategic Resource. McGraw-Hill, 1997	34

APPENDIX C
ASSESSMENT METHODS BY PERCENT OF TOTAL

School	Exams	No.	Quiz	Cases	Research/ Topic Study	Project	Participation	Report	Assignment
2	30	1	20	15	20	10	5		
3	30	2		20	20		30		
4	35	2		24	12	17	12		
5	25	1		40		20		15	
6	45	2	20			15			20
7	40	3	25						35
8	35	2		15	15	30	5		
9	63	2			5	24			8
10	100	3							

School	Exams	No.	Quiz	Cases	Research/ Topic Study	Project	Participa- tion	Report	Assignment
11	45	3				20			35
12	50	2		30	20				
13	20	2		20			10	20	30
15	70	2			15		5		10
16	50	1					50		
17	50	2		25	25				
18	80	2					20		
19	40	2				35	20	5	
20	50	2		8	18			24	
21	30	1		25	45				
22	80	4							20
23	50	2		30	10				10
24	50	2		25			12.5	12.5	
25	25	1		25	25		10		15
26	40	2			35	15	10		
27	40	1			25	25	10		
28	80	4					10		10
29			25	25	25		25		
30	40	2	5	20		20	10		5
31					50		50		
32				25	30		20		25
33	75	3			12.5				12.5
34	20	1	30		30				20
35				20		30			50
*36									
37				20	10		40		30
38				30	30	30	10		
39	25	1		40			35		
40	55	2			25	20			
41	40	1		25			10		25
42	50	2	30	8			12		
43	30	2		20		10	15		25
44	60	3				30	10		
45	25	1		20		30	15		10
46	37	2				63			
47	20	1			20	30	15	15	
Average	??	??	??	??	??	??	??	??	??
Std. Dev	19.33	0.8	8.59	7.79	10.88	11.81	12.76	6.51	11.7
Number	38	38	7	24	23	19	27	6	19
Max	100	4	30	40	50	63	50	24	50
Min	20	1	20	15	5	10	5	5	8

School	Exams	No.	Quiz	Cases	Research/ Topic Study	Project	Participation	Report	Assignment
Used by	84%		16%	53%	51%	42%	60%	13%	42%

*no grading data

APPENDIX D
TEAMWORK PERCENT

School	Total	Cases	Research	Project	Reports	Assignments
2	20		20			
3						
4	24	24				
5	60	25		20	15	
6	10			10		
7						
8	60	15	15	30		
9	29		5	24		
10						
11	55			20		35
12						
13						
15	15		15			
16						
17						
18						
19	35			35		
20						
21						
22						
23	10		10			
24						
25	50	25	25			
26	15			15		
27	50		25	25		
28						
29						
30	40	20		20		
31						
32	25	25				
33						
34	30		30			
35						
36						

School	Total	Cases	Research	Project	Reports	Assignments
37						
38	30	30				
39	40	40				
40	25		25			
41	25	25				
42						
43						
44	10					10
45	50	20		30		
46	45			45		
47	30			30		
Average	32.63	24.9	18.89	25.33	15	22.5
Number	24	10	9	12	1	2
% of total(44)	55%	23%	20%	27%	2%	5%
Max	60	40	30	45	15	35
Min	10	15	5	10	15	10

APPENDIX E
COURSE TOPICS

Total	Topics	Schools
32	strategic applications of IT	2,3,4,7,8,10,11,13,15,16, 19,21,22,23,24,25,26,27,28,29, 31,32,33,34,36,37,39,41,42,43, 45,47
28	information age organization: IT design and management	3,5,7,11,12,13,15,17,18,19,22, 23,24,25,26,30,31,32,33,34,35, 36,39,41,42,43,45,47
27	systems development process (planning, building, managing)	4,6,7,8,9,10,11,13,15,20,22,23, 24,25,26,28,29,33,34,37,38,39, 43,44,45,46,47
27	IT architecture and infrastructure	2,3,5,6,8,12,13,15,17,18,22,23, 24,25,26,27,32,33,35,36,37,39, 41,42,43,45,47
25	telecommunications fundamentals	2,7,8,10,11,13,15,17,20,21,22,23 24,26,28,31,33,35,37,38,39,42, 43,44,45
24	IT enabled process redesign	2,5,7,10,13,15,17,18,19,22,23, 24,25,26,27,33,34,35,36,39,41, 42,43,47

Total	Topics	Schools
23	types of systems and evolution of IT (TPS, DSS, GDSS, EIS, ES, etc.)	2,5,6,7,8,13,18,20,21,22,24,26,29,30,31,33,37,38,39,42,43,44,46
21	electronic commerce	2,5,8,10,16,18,19,23,25,26,27,29 31,32,33,35,39,41,42,45,46
21	database fundamentals	2,6,7,9,13,15,20,21,22,23,26,28,29,30,33,35,38,39,43,44,46
17	decision support (individual, group, organizational)	4,5,10,13,15,17,18,22,23,24,26,28,33,37,38,41,44
16	interorganizational systems/strategic alliances	2,5,8,12,13,15,17,24,25,26,31,32,33,35,36,41
15	fundamentals of HW and SW	2,7,13,15,18,20,22,23,24,26,28,35,38,39,43
13	security/privacy	5,7,9,16,19,20,22,26,33,39,42,44,46
12	information resource management	4,10,11,12,13,19,23,26,33,37,42,45
12	ethical issues	7,12,15,19,23,26,30,39,43,44,46,47
12	human side of technology/the individual and IT	4,5,15,17,18,23,26,31,37,39,42,44
11	global systems	2,12,15,21,23,24,25,26,32,36,45
10	outsourcing	2,5,19,25,27,29,34,42,45,47
8	client/server	2,9,18,25,29,34,42,45
8	managing IT risks	5,12,5,16,21,25,26,34
7	acquisition/implementation issues	5,16,20,24,25,27,34
6	frameworks for IT enablement	5,6,8,15,24,25
6	justifying IT investments	5,12,25,33,41,44
6	emerging technologies/web technologies	16,23,25,26,27,43
6	future impacts of IT	2,12,15,17,26,42
6	data modeling	6,9,11,13,21,23
6	IT and productivity	10,13,18,25,30,34
4	managing IT function/role of CIO	32,32,39,47
4	PC applications: database	4,6,8,11

Total	Topics	Schools
3	end user computing	4,20,46
3	collaborative work	18,42,43
3	system failures	2,16,25
2	data warehousing	13,18
2	PC Applications: building a web page	8,11
2	knowledge management	31,42
2	IS career/personnel issues	10,20,
2	disaster recovery/planning	15,20
1	multimedia	16
1	PC applications: PowerBuilder	9
1	project management	5
1	TQM & IS	31
1	PC applications: spreadsheet	4
1	electronic document management	37

SELF-DIRECTED TEAMS IN THE INTRODUCTORY INFORMATION SYSTEMS COURSE: LESSONS LEARNED

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Research clearly supports the efficacy of self-directed teams. This paper proposes that the use of self-directed teams demands a considerable amount of direction on the part of the instructor. Students in two sections of an introductory information systems class were surveyed with explicit questions about their experience as part of a team in this class. Findings indicate that an evolution of approachcs in structuring teams is a necessity. Results suggest that a systematic and formal evaluation of the collaborative learning experience is desirable.

INTRODUCTION

It is generally accepted that the use of teams promotes the learning of information systems (IS) skills. It is also generally accepted that teamwork is one of several techniques, along with active class discussion, case studies, debates, games, simulations, etc., for facilitating this learning. Principle reasons for teamwork include:

1) active learners are more effective learners (Hassard 1990)
2) not all students learn in the same way—some have verbal orientation, some are "hands-on," along with a plethora of other dimensions
3) teams serve as a vehicle for promoting communication, people, and problem solving skills, valued in both the business and academic worlds (National Institute of Education, 1984)
4) the business world routinely expects professional school graduates to have experience with teamwork
5) collaborative learning fosters more efficient and effective processing and retention of information (Johnson, 1991; Keeler and Anson, 1995).

Although there is widespread agreement on the positive benefits, there is no universal agreement on the techniques which will best deliver these benefits. Should teams be self-selected or should they be formed by the students? Should students be graded individually, as a team, or some mix? Are teams most appropriate for upper level classes, or are they suitable for all levels? The literature has addressed these and many other questions (see, for example, Rau, 1990, and Pollalis, 1995).

It seems reasonable to assert that the success of particular techniques are influenced by a number of factors, including prominent factors such as knowledge and maturity of the students, the teaching style of the instructor, and the content and goals of a particular class, will influence the outcomes of collaborative learning. One common approach to teamwork is "self-directed teams," which puts the team at the center of learning where the instructor becomes more of a guide than the source of all knowledge, circulating among the teams, responding to questions, monitoring the progress of groups (Dutt, 1994). "Self-directed" is somewhat misleading, because it does not mean that the instructor abdicates all responsibility for the team's performance. Rather, the instructor is actively involved in establishing the general objectives, and having the teams responsible for determining many of the rules for accomplishing those objectives.

One of the most challenging courses to exploring student teams is the introductory IS course. A wide range of topics and a wide range of student backgrounds necessitate an approach different from a constant diet of lecture and note taking.

I have taught introductory IS classes to undergraduates for most of the past ten years, and like many instructors, have gravitated away from heavy reliance on lecture to a much greater dependence on self-directed teams. I began my evolution toward teamwork both because of the five principles cited above and because of a sense of frustration with the level of learning in class. Many students simply were not understanding the material to my satisfaction. At first, I resisted the idea of teams because of fears that I was not fulfilling my duties when merely circulating among busy students and because I was fearful of not covering all the material dictated by the course outline. Nevertheless, my frustration with the old methods proved sufficient motivation to begin experimenting with self-directed teams.

I choose the term "experiment" deliberately, for I firmly believe there is not one tried and true approach. Over the years, I have continued to modify my approach, relying on intuition, reports from colleagues, suggestions from the literature, and feedback from students--including both standard instructional reports and anecdotal evidence. This past year, I have finally hit upon an approach that leaves me reasonably satisfied with student performance. In addition, I believe I have only crossed the threshold of satisfactory performance, and have become excited about the possibility of a quantum leap in improvement for the coming year. The reason for the excitement is due to a technique already employed by many of my thoughtful colleagues, and a technique I heartily endorse for anyone regularly teaching introductory IS. That technique consists of formulating a questionnaire especially designed to evaluate student thoughts and beliefs about the team approach; furthermore, I ask the students open-ended questions about future improvement. Of course, results must be interpreted sensitively and thoughtfully, for not all responses can be taken at face value.

THE COURSE

All of us who teach introductory IS have environmental factors at our schools which force modifications to our approach to collaborative learning. At my school, the course is a general education course, and must meet University-wide general education requirements: both oral and written presentations are required as part of the course work, for example. As such, we have a few juniors and seniors along with many freshmen and sophomores. The course is a required one for all business majors, but other majors, e.g., nursing and the professional pilot program, require the class of their majors. Like many schools, we have a wide range of competencies represented in each class.

Another factor influencing collaborative learning is poor facilities: although the classes typically enroll 37 students, the business lab has only 24 networked PCs. It was partly because of this imbalance that I moved to a team approach. My solution was to divide the teams into ten teams of three or four students, with a "captain" in each team. The captain is always computer literate and has the job of serving as consultant for teammates who are learning computer literacy. This arrangement creates a job for everyone during lab times. I spend half the term in the labs, and I have found that unless I am there monitoring progress, the majority of students do not learn competency. There are fifteen projects to complete during the course of the semester. Roughly half of these projects stress basic competency, and the other half stress higher order learning. The software for the course includes word processing, spreadsheets, e-mail, Internet, with progressively more multitasking required.

THE QUESTIONNAIRES

I presented students with an explicit questionnaire, designed to test the students perceptions of the collaborative learning in the labs (see Appendix A). Students received a bonus of two percent of the course grade for conscientiously filling out the forms. Students were required to include their names on the questionnaire, so that I could perform more detailed analysis.

I was very impressed with the sincerity of student response. I believe I established a great deal of trust with the students during the term. They were guaranteed that their responses would in no way reflect upon their course grade, other than receiving a two-point bonus. The depth of thought put into the open-ended questions was impressive. Furthermore, there was no missing data for any of the twenty-five objective questions.

I administered the questionnaire to two sections of introductory IS. One class was composed of 36 students, and the other 33. There were no obvious demographic differences between the classes. In the first class, 27 students took the survey; 28 in the second class.

FORMING TEAMS

There are many approaches to forming teams, a number of which have proven successful. Student selected versus instructor selected is the first, and perhaps most important, consideration. While some have reported success with students' self selection, this procedure is not viable at my school. Given the wide variation in skill levels, it seems heartless to leave team formation to the students. This is an instance where I chose to ignore the students responses to the questionnaire: 15 percent of the students indicated that the most important change to make for next year (open-ended question) would be to let students form their own teams. Of course, those students who found themselves on poorer teams or those students who already knew some of their classmates are inclined toward student-selected teams. However, allowing students to self-select teams would doubtless result in an even greater variation of team ability. My deepest sympathies lie with those shy students with few computer skills--it is my duty to ensure they are placed on a team with some expertise. Dutt (1994) reports that cooperative learning research indicates that teams are more likely to be successful when membership is defined by the instructor.

Like Dutt, I made it my goal to have the teams as heterogeneous as possible. To do so, on the first day of class I had students rate themselves on their degree of expertise in each of five areas: operating systems, word processing, spreadsheets, database, and programming languages. Students ranked themselves on a scale of 0-5, with zero indicating no experience, one indicating a novice, and five indicating expert status. In both sections, there were enough experts to allow the formation of ten teams, composed of three or four students. Each team was guaranteed one expert, with the remainder distributed as heterogeneously as possible.

It must be understood that this procedure has its flaws. Students do not always evaluate their expertise accurately. As it turned out, in each section there were two to three experts, deemed captains, who either did not have the advertised expertise or the sense of responsibility to serve as team leader. This inaccuracy can be corrected by including a few key questions which will allow me to evaluate their expertise. For example, to evaluate students' expertise with spreadsheets, students can be asked to explain the difference between relative and absolute addressing. However, assessing students' depth of responsibility may be more difficult. Our introductory IS classes have a sprinkling of juniors and seniors, and we lso tend to have 25 percent nontraditional students. Because upperclassmen and nontraditional students tend to have more maturity, perhaps responsibility can be distributed heterogeneously as well.

Nevertheless, I am reasonably satisfied with the team captain approach. I am flexible enough to allow captaincy to shift from project to project, as the students see fit. I am encouraged that 18 percent of the students reported that the number one practice which should be unchanged next year (open ended question) is the way teams are formed. Some fine-tuning of the captaincy will occur next year, and I anticipate greater success.

GRADING

According to Dutt (1994), how to evaluate team performance is the major challenge that cooperative learning faces. Whether to grade students individually or to grade them as a team is a question which has not been resolved. At one extreme are instructors who perceive that the most important duty of a professor in the classroom is to discriminate among students; thus elaborate schemes are devised to evaluate individual student performance and to subtract, as much as possible, the effects of total team performance.

On the other extreme is a report from one of the leading employers of our students (USA Group, 1998). The contention from this company was that in the business world, teams are evaluated solely on team effort, with individual contribution irrelevant. The company strongly encourages university teamwork be graded based solely on the merits of the team efforts.

Questionnaire results on this issue were mixed, with about equal numbers of students supporting a heavier emphasis on team output versus individual grading. Perhaps Dutt's (1994) suggestion, that evaluations be a mix of student and team grades, is the best. This is the approach I used--some projects were graded individually and some as a team. There are a number of innovative approaches to fine-tuning this mix problem. One of the more innovative approaches is to have students take exams, first as individuals, and then as a team effort. Eighty percent of the final grade is individual, and twenty percent team (Dutt, 1994). Student response to this approach was neutral, with virtually equal numbers agreeing as disagreeing.

STRUCTURED TASKS

At this point, I feel it is necessary to interject what may be obvious to some. Using self-directed teams does not imply that tasks for these teams are unstructured. It has been my experience that the more clearly requirements are specified, the more closely student performance will match high expectation. This observation has proven valid not only for the introductory IS class, but for all my classes. Typically, short projects will have one-page specifications, and longer projects two-page specifications. Clear specifications have the added virtue of making the grading process more clear cut. The amount of latitude students have in meeting the specifications depends on the project: if the project is geared to computer literacy, there is little latitude. For those projects focusing on higher order learning skills--

application, synthesis, evaluation--students have more of a free rein.

STUDENT REACTION TO TEAM WORK

One encouraging result from the questionnaire was the student support of the team approach. Students strongly agreed (average of 4.30) that teamwork was an important part of the college experience, and strongly agreed (4.4 average) that teamwork was an important skill for the business world. Students agreed (average 3.78)) that working in teams was useful in learning computer skills in this class. Reaction to the team concept on the open-ended questions was heavily supportive.

LEARNING

Research has shown that, in a number of areas, students learn better in teams than as individuals. Questionnaire results lend some support to the contention. Students support the contention that working in teams was valuable in learning more quickly (average equals 3.78) and that working in teams was an aid in better remembering the concepts (average equals 3.56).

Other results include:

Working in teams promoted higher order learning	3.65
Working in teams promoted spreadsheet learning	4.02
Working in teams promoted understanding of How computers work in the business worl	3.80

Less encouraging were these results:

Working in teams promoted writing skills	3.05
Working in teams promoted speaking skills	3.02

According to Dutt (1994), one of the advantages of teamwork is an increased self-esteem, an increased bonding with students and with the university. Such results make for laudable objectives, particularly with freshmen at universities where student retention is an issue. However, students did not support the contention that the teamwork made them feel more a part of the university (2.60). A few of the open-ended responses indicated that the use of ice-breaking exercises early on would alleviate the shortcoming.

PROJECTED CHANGES

Because of the formalized feedback provided by students, I anticipate an unparalleled magnitude of changes for the upcoming academic year. The literature and student feedback both support the expansion of teamwork to the classroom. Although the questionnaire was limited to questions concerning lab work, several students indicated in the open-ended questions that whereas the labs were satisfactory, the classroom could benefit from more teamwork. Student attendance in the lab sessions tended to be 20 percent higher than in the classroom, testimony to the potential of expanding teamwork to the classroom.

In a similar vein, students supported (open-ended question) the idea of expanding the number of team projects at the expense of individual projects. I believe such an expansion is tenable, particularly for those projects calling for higher order learning.

The literature suggests increased student involvement with teams if initial ice-breaking exercises are used. Student feedback was not so strong here, with an average of 3.07 agreement with the idea of ice-breaking activities. Nevertheless, intuition tells me that this is an instance where I should risk the attempt. Potential benefits far outweigh the cost of what students may perceive as trivial and unimportant activities.

I have been slow to move toward the fourth generation of introductory computer skills (Michelini, 1995) in the area of word processing. Fourth generation includes a move into desktop publishing and away from word processing. Although most of the emphasis on the three explicit word processing projects was on intelligent formatting, I would characterize this year's work as third-and-a-half generation. Student feedback indicates that while students tend to agree (average equals 3.95) that they learned a great deal about word processing, there is perhaps room to move into even more desktop-oriented exercises.

One of the student projects culminated in a formal oral and written presentation of team research into social, legal, and cultural ramifications of information systems. Of course, formal oral presentations are an important part of our class in order to satisfy general education requirements, as well as being an academically sound practice. However, I have been very dissatisfied with the quality of the oral presentations. Some teams have done the necessary preparation and rehearsing to pull it off. The majority of presentations, while of generally sound content, were very lacking in polished delivery. In spite of repeated admonitions on my part, many students chose to read virtually their entire report.

Students tend to agree with my assessment. The question "Student presentations of such issues as ergonomics, computer crime, disaster planning, etc., are more effective than learning from a teacher" received a neutral 3.07 average response. I have reluctantly concluded that if improved delivery is desired, then changes will have to be made. Perhaps more direction from me about what is acceptable and what is not acceptable is part of the solution. Perhaps raising the point value of the oral presentation (currently four percent) is necessary. Perhaps videotaping multiple student presentations is the answer.

SUMMARY

Teaching introductory information systems is an ongoing challenge. Self directed teams have been shown again and again to produce positive results in learning computer skills, in learning communication skills, and in learning interaction skills. This study has generally supported those findings.

However, defining the role of the instructor is also an evolutionary process. Trial and error approaches, over time, tend to produce more satisfactory results. A more systematic approach, including reliance on student feedback and analysis of student performance, yields promise of more rapid evolutionary advances.

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APPENDIX A
STUDENT QUESTIONNAIRE

LAB QUESTIONNAIRE Name:
MIS 276
10 points

[For the first 24 questions, students responded on a scale of one (strongly disagree) to five (strongly agree).]

1. Learning to work together in teams is an important part of the college experience.

2. Working in teams is an important part of the business world.

3. Working in teams helped me learn to use the computer more quickly than working alone.

4. Working in teams has helped me to remember better how to use the computer.

5. In order to successfully work on teams in this class, I had to do more thinking than just learning facts.

6. I gained experience with writing skills in this lab.

7. I gained experience with speaking skills in this lab.

8. I learned a lot about spreadsheets in this lab.

9. I learned a lot about word processing in this lab

10. I learned a lot about using the Internet as a research tool.

11. I learned a lot about how computers are used in the business world in this lab.

12. Working on teams made me feel closer to the University.

13. I feel I have learned a great deal about computers with my lab work.

14. We should spend less time on word processing and more time on desktop publishing (publishing newsletters, flyers, etc.).

15. Student presentations of such issues as ergonomics, computer crime, disaster planning, etc., are more effective than learning from a teacher.

16. The course should have group exams as well as individual exams.

17. Students should receive individual grades rather than one team grade for the Scavenger Hunt and for the written team report.

18. I spent a lot of time working with others on the lab assignments.

19. I learned more from my teammates than they learned from me.

20. Each of the members of my team contributed about equally to the team projects.

21. I contributed my fair share to the team project.

22. Students should have more control in forming teams.

23. Students should be allowed to grade other team members' efforts.

24. We should have more team-based projects; for example, deriving a name for the team, establishing rules for members' behaviors, publishing a team newsletter, researching information systems in a real company, etc.

25. Where did not of your computer learning come from? Circle the appropriate response.
A. team B. yourself C. instructor D. none of the above

26. If you could make one change to the way teams operate for the next semester, what would it be?

27. If there was one thing you believe should remain the same next semester, what would it be?

USING A TEAM BUILDING EXERCISE TO ENHANCE THE SOFTWARE DEVELOPMENT PROCESS

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Mary J. Granger
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Extended Abstract

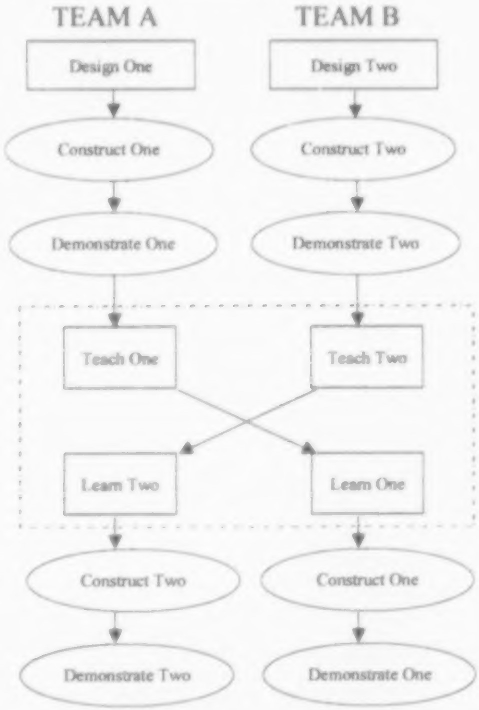
INTRODUCTION

This paper presents a team building exercise used to facilitate improvement of information systems students' interpersonal interaction and communication skills and to generate enthusiasm for successful completion of a team-based programming project. In an attempt to foster team building in a programming and data structures course consisting of undergraduate and graduate students, a team building exercise (Fearon 1997) was used. The team activity is known as *Humpty Dumpty Had A Great Fall.*

An introductory programming course is sometimes considered dull, boring, and difficult. Students may consider the course just another prerequisite and may not find the subject matter interesting. Students are often required to complete assignments independently. This exercise is an attempt to prepare students for the business environment where software development is usually accomplished in software development teams. This exercise enables students to work together in a team building exercise prior to working together in the design, development, and coding of a programming project. It emphasizes the importance of collaboration and team inter-dependence and is easy to implement in a classroom environment.

In order to solve the given problem, students are required to design, construct, and demonstrate a working model. Since teams probably have different methods and models to resolve the task, a team (Team A) then teaches a different team (Team B) the intricacies of building their working model. In turn Team A is taught Team B's working model. Eventually each team constructs the other team's working model and demonstrates it (Figure 1). This exercise fosters team building, design strategies, prototyping strategies, teaching, learning, and model construction all within a designated timeframe.

FIGURE 1



THE EXERCISE

The *Humpty Dumpty Had A Great Fall* exercise enables students, as team members, to work together in crafting a solution to the following problem: Using only the materials provided, design, construct, and demonstrate a working model that enables Humpty Dumpty, a raw egg, to travel from a height of at least 3 feet and come to rest 3/4 of an inch off the floor without cracking. During the first phase, designing a model, teams are given 30 minutes in which to complete the assignment. The team must then demonstrate their prototype three times to the instructor.

Initially, teams are given oral, as well as written, instructions regarding both phase one and phase two requirements. In phase two, teams are paired such that Team A teaches Team B and Team B teaches Team A. Each pairing uses only oral instructions to explain their initial design. During this phase, teams decide on an implementation strategy. How do we construct this new model? What materials do we need? How should we allocate responsibilities? Who should teach? Who should learn? Teams are then required to demonstrate their newly learned, completed, working model three times. The goal is to successfully complete the most demonstrations out of six attempts.

USEFULNESS OF THE EXERCISE

The purpose of the exercise is to give team members an opportunity to work together as a unit - teaching, learning and doing, on a non-structured project prior to constructing a 4 week long programming project. Members discuss strategies, helpful in the prototype's design and model construction. This simulation provides an opportunity for students to see that there are many different ways to accomplish the same task - an important concept in software design. At the completion of the exercise, issues raised and addressed include: the importance of who the end user will be; is one design better suited for one type of end user over another?; is one design too complicated to be constructed given the supplied materials?; does the design take too long to create given the time requirements?; is it a great design on paper but not when completed?; why one method was "better" than another. Students see that there are different factors impacting the decision-making process and each should be considered. Students also have an opportunity to discuss the strengths and weaknesses of their own models.

SUMMARY

An unstructured team activity can reinforce the importance of team cohesiveness in systems design. Although the exercise is unrelated to the actual task and is a physical, not a logical dilemma, lessons learned about team building can be transferred to the assigned task. The students began to build camaraderie before they tackled their programming project. They began to understand how their team members interacted when faced with a playful task. They also realized that there is often more than one solution or model for a given problem. This is a difficult concept, especially for undergraduates always looking for the 'right' answer and accustomed to memorizing their schoolwork. It helps them begin to think about issues and transfer their knowledge to new situations.

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WEB-BASED DISTANCE LEARNING

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The enormous amount of information available, the increasing competitiveness of institutions of higher learning, and the changing needs of today's students all work to make distance learning an important vehicle for the delivery of instruction for colleges and universities. This paper presents an overview of these forces, describes general development issues and benefits, and describes the design and implementation of a web-based CIS course.

BACKGROUND

We are living in an era in which information virtually doubles every three years (Naisbitt and Aburdene, 1990). Work requires higher and higher information skills and our students have to share cultural understandings about the world that cannot come out of textbooks alone (Toffler, 1990). Educational researchers examine academic standards and call for reform in the way instruction is delivered (Bishop, 1991.) The "chalk and talk" model prepares students to work in an old fashioned factory with its emphasis on following instructions, discipline and routine tasks. The needs of a modern, global economy include the ability to process information symbolically; to read complicated manuals and diagrams; to interact with many people; to master a high degree of specialization; to work, plan, learn and react independently (PPI, 1991.) Students need to develop the skills of leadership, negotiation, teamwork and cooperation (Weiss, Carbone, Wyeth, 1991 Researchers propose seven areas for change:

1. Tasks must be meaningful and challenging
2. Students must have control over their learning through choice and decision making opportunities.
3. Students' achievement must be based on progress, effort and improvement rather than performance measured against others.
4. Student grouping should be based on interest and heterogeneity.
5. Evaluation must be used as feedback.
6. All students must have equal access to school resources.
7. Flexibility in the use of time for innovative interdisciplinary instruction has to be instituted. (Maehr, Midgley and Urdan (1992).

The challenges posed to higher education by increasing costs, declining enrollments, the diverse learning styles of students, the demands for accountability, the rapid advances in information technology, have created an environment conducive to the development of alternative ways to deliver instruction. Today's undergraduates are not just traditional eighteen-year-olds but adults from diverse socioeconomic backgrounds seeking skills for their careers, many of them have families. They no longer want a "just in time" education, they seek "just for you" customized education tailored to meet their specific lifelong learning requirements. (Cause/Effect Winter 1997-98.)

ADMINISTRATIVE ISSUES

Marketplace

In 1995, seventy-five accredited U.S. colleges and universities offered on line degrees. A recent issue of The Chronicle of Higher Education, projected that by the year 2000, 97% of universities will offer courses on line. Duderstadt (Winter 1997-98) pointed out that we can anticipate a 30% growth in demand for education services over the next two decades. Currently, distance programs include the Western Governors University, a virtual school that will make accessible electronic course from colleges and universities throughout the nation. Duke, University of Virginia, NYU, UTEP, University of Phoenix. Corporations are also engaged in on line and multimedia distance programs, Motorola, Xerox, Fed Express, Microsoft on Line Institute, and the Home Education Network are all engaging in a $50 billion dollar a year marketplace. That market is expected to grow to over $200 billion just to keep pace with the demands for a technologically astute workforce.

Format

Delivery of a distance class can be on video, audio/slide, print, CD-ROM, E-mail, Web based, chat/conference, and or all combinations of these. Do you have the expertise to design and deliver through a variety of multimedia? Are you prepared to be an instructional designer, graphics artist, digital video and audio technician, a webmaster or administrator of a server? Does your institution have people to assist you? It is important to consider the format for delivery and the resources available to you. The format must fit your market.

World Wide Web Delivery

A recent estimate of cyberspace suggests that there are about 320 million web pages, and even the best search agents are able to index only 40% of them. In the next few years the number of web pages is expected to grow by 1000% (S. Lawrence, April 1998). This makes your web course a needle in a cyberstack.

So what can you do to distinguish the course? How will you gain an audience? How and who will sell it? A recent survey of institutions offering distance learning classes indicated that 68% of the students taking courses were already students on campus. When queried about how they advertised the classes it was to their existing student base. So if your goal is to increase market share a full global ad campaign is essential. Do you have the budget to compete in an ever-crowded arena?

Benefits

The perceived benefits of distance and on line learning can be summarized as:

a. Convenience because today's students work late, travel, are homebound and cannot easily make traditional on campus classes

b. Cost are less expensive to a student, for example, the University of Phoenix offers an MBA which costs $21,000 or about half the price of its on campus counterpart at the University of California. A three-day workshop cost $1,800 plus travel while the same on line training program will cost $600. On site training can range from $12,000 to $17,000 for three one-day sessions, while the cost for the same number of employees on line is $3,000.

c. Real life situations are built into distance learning. The challenges of budgeting time, working with technology and cross discipline teams, cultures and perceptions and communications issues.

d. Fosters knowledge about electronic commerce and virtual organizations.

e. Learning is tailored to the individual, education that is "just for you".

f. Engages the student in the process of learning. You cannot hide in the back of an electronic classroom.

g. Instructor expertise is extended to a larger population.

Administration, Faculty and Student Roles

The Administrator role is to reorganize work, empower the faculty, encourage collaboration, establish the business partnerships, and provide the environment, inspiration and leadership to move a campus forward in the process of delivering instruction. The faculty will be assuming the role of a change agent by creating a student centered virtual learning community. They become designers and managers of learning experiences. They no longer do the "work of teaching" They create an environment that shifts the "work of learning" to the student. The students become the center as interactive collaborative learners.

Copyright Issues

The Intellectual Property Issues must be resolved. Clear allocation of copyright ownership and control is necessary to avoid disputes over electronic course materials. Who owns the content? Are all graphics and text cleared for digital publication? The present state of copyright law is not clear when it comes to web based instruction. Is the work a commissioned work created by an independent contractor? Is the work a "for hire"? If so, ownership belongs to the employer rather than the creator; works with an institutional author are protected for 75 years, while works individual authors have protection for 50 years. Investigate the options, they seem to fall into two models of ownership, the "patent model": ownership transferred from the inventor to the sponsoring institution, or the "text book model": the author retains the copyright and assumes the primary responsibility for licensing and managing the book (Burk,1997.) It becomes imperative for faculty and administrators to develop an appropriate intellectual property policy. Whatever model is selected, be sure to consider that the licensing, policing, and enforcement of copyrights requires rigorous management.

Faculty Time and Workload

Collaborative efforts are needed to commit to paper the ways that faculty allocate their time. Teaching, research and creative work, service and professional development seem to be the four areas that need redefinition. Where does Web-based Distance Learning fit? Do you consider Distance Learning courses as regular work or it is a part of overload pay. Have you considered the reward structures for the faculty? Will your program require redevelopment of curriculum? Will faculty receive time, recognition and pay for the project?

Ten Step Development Process

It is a difficult task to storyboard a course that fulfills the mission to create a challenging and novel environment, one that helps learners connect new information to past knowledge, search for meaning and think about how they learn within a virtual learning community (Bonk & Reynolds, 1997.) It is also not an impossible activity. Try the following ten-step development process:

Step 1: Establish a clear definition of:
  a. Goals
  b. Objectives
  c. Learner Outcomes

Step 2: Define Prerequisites.

Step 3: Create a Course Syllabus.

Step 4: Profile the Instructor.

Step 5: List all the Required Materials.

Step 6: Provide Additional Resources.

Step 7: Establish Assessment Methods.

Step 8. Pilot the Course.

Step 9: Collect Data for Revision and Refinement.

Step 10: Go Digital - Get Wired.

Measurements

Establish a measure for each step against criteria. Some issues that you might consider are:

1. Have you created a motivating learner centered environment?
2. Have you incorporated challenge, fantasy and curiosity into a variety of activities?
3. Do the exercises engage students in divergent or creative thinking?
4. Does the course include conferencing/interactive chat requirements for thinking about related activities?
5. Are students required to create graphic representations of knowledge?
6. Do they have to categorize or prioritize ideas?
7. Are students asked to role-play, engage in case studies, debate and hold mock trials, write reflections?
8. Do students form teams, define projects, research them, carry them out and present the results?
9. Are students encouraged to use the capabilities of the web to use text, graphics, animation, sound and video in their presentations?
10. Have you included electronic mentorships?
11. Have you used E-mail to increase communication?

RETROFITTING A CIS COURSE FOR WEB DELIVER

The Course Description

CIS 001 is a 3 - credit literacy/lecture course with a 30% lab component. It typically runs in a 13-week semester setting, but has been offered in 4 or 5-week sessions as well. The body of the course consists of lectures and hands-on lab sessions. A student's grade depends upon 7 - 8 quizzes, 5 lab assignments, 2 in-class exams and a final exam. The lab assignments may be resubmitted for higher grades.

Immediate Rationale

An Introduction to CIS course has been taught at a local high school for college credit. While the course was enthusiastically received by the students, there were logistic problems in matching the instructor's schedule to theirs. Their high school was on a block schedule, which meant that class met Monday, Wednesday and Friday one week and Tuesday, Thursday the next week, on a rotating basis throughout the semester. The instructor taught classes on Mondays and Wednesdays at the college and was free only Tuesdays and Thursdays for the High School project. This was one impetus for the development of a web-based distance learning course, which would not be tied to particular days and times.

A second impetus was the recognition that this student population at this high school was a small part of a larger student population covering all the high schools interested in participating in this project. We could reach a wider audience, without requiring a minimum number of students at a particular high school, without having an instructor at each school.

Finally, the nature of this course lends itself to web based delivery. Since this is mainly a lecture course with a lab component, interaction between students is not a necessary component. This type of course would be relatively easy to implement and present. This would side step the issue of whether web based delivery using chat rooms and email can accommodate class interaction.

Administrative Support and Funding

This will be the first for credit web-based distance learning course offered by our college, and our Provost was interested in supporting the development. The faculty member proposed taking an existing course and retrofitting it to suit web-based delivery. Anticipating that this project would be time-consuming, she looked for college funding. Our school offers two in-house mechanisms for funding faculty projects. One mechanism is governed by faculty and administrators and approves funding for faculty research and development, but does not extend to classroom development. A second mechanism, rarely used, provides for administrative release time from normal teaching loads, and is granted by the Provost with the concurrence of the Executive Board of the Faculty Union. The faculty member applied for and received six credits of release time for our Winter session. Issues of copyright are yet to be addressed by the faculty union and administration.

Hardware and Software Requirements for the Student

A student would be required to have internet access. The college or an external internet service provider could provide this. In our situation, our local county public library system offers free internet accounts to all residents.

A student would need access to a computer running Word97, Excel97 and Netscape.

Design Considerations

It was decided to offer the course during a specific time frame. Open-ended projects require a high level of self-discipline and the course material is somewhat time-dependent, with new versions of software offered annually and technological capabilities changing rapidly. Since we had a pilot audience already available at the local high school, we would offer the pilot either during a summer session or during the regular fall semester.

Arrangements must be made for proctoring exams. It would be impractical to have 8 quizzes and 3 exams proctored. Since the quizzes serve to focus a student on what is important, a decision was made to offer self-grading quizzes which would not be included in final grade calculations. The other 3 exams would require a proctored environment. Arrangements would be made at the local high school for proctoring. Completed exams would be mailed to the college.

Completed lab assignments would be uploaded on the web to the instructor. They could be graded and returned with comments in a similar fashion. Each student would have the opportunity to resubmit lab assignments for higher grades.

The syllabus, class lectures, step-by-step lab instructions, self-grading quizzes and project assignments would be available on the web throughout the semester. For this pilot project the presentation will be limited to text. It is anticipated that graphics, sound and video will be added in later offerings.

Upon registration, a student would be assigned a password to access the web-site. Each student would have file space to which the instructor could send documents, and the ability to send/receive messages and files. This latter ability to send/receive files is vital; mail attachments do not work universally. Web-based file transfer through Netscape is more reliable.

The Delivery Mechanism

Internally hosting such a course requires network and telecommunication resources sufficient to enable 30 or more people to go online. It requires the ability to distribute and update the content, and handle help desk questions 24 hours a day, Our college does not have the equipment or the staff expertise to host such a course internally. We decided to select a software product to serve as a delivery mechanism, and partner with an external agency to manage the delivery.

The software packages that we are considering include LearningSpace, from IBM and TopClass, from WBT Systems. Both packages have professional presentations of courses, chat facilities, online quizzes, document transfer capabilities and private connections between student and instructor. We plan to select one of these packages and launch our course sometime this summer. Initially the class will be limited to 20 students. Past experience has shown that the number of email messages a larger class can generate will overwhelm one instructor.

Summary

To maintain a competitive edge, colleges and universities must look to providing customized courseware to a larger, more diverse audience using a variety of distance learning formats. Issues such as copyright, workload, administrative support and implementation choices must be addressed. Our pilot course uses web-based delivery and initially aims at the high school market.

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WEB-BASED DISTANCE LEARNING: CHOOSING EFFECTIVE TECHNOLOGIES FOR INFORMATION SYSTEMS COURSES

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The emergence of newer web-based technologies has resulted in increased offering of distance education courses in just about every academic area. However to a great extent the choice of technology is basically governed by the availability of technology rather than by the appropriateness of the technology for the course being taught, and for the learning outcomes. Although the importance of IT in education is realized, literature review shows that there is some disagreement on effectiveness of IT as a main educational tool, requiring further empirical studies. In this paper we discuss our ongoing empirical research to identify the relationships between the course variables, student variables, instructor variables and the appropriateness of the technology for the learning objectives. Existing technologies for distance education have been identified and categorized. Survey instruments for IS students and faculty have been developed.

INTRODUCTION

Distance education has existed in the academia for many years, but they have traditionally been in subjects which do not demand a strong interaction between the students and the teacher. However the newer technologies involving the Web and multimedia show promise in supporting interactivity. Today we have a plethora of instructional delivery options using the Internet, in addition to the traditional distance learning technologies such as videotapes or audiotapes. Successful offering of distance learning requires a careful selection of technologies based on their appropriateness for the learning objectives for the course modules.

We have begun to see distance education courses being offered in just about every academic area. Today, there are a wide variety of technologies available to deliver instructions. These range from the simple plain text at one end to compressed video at the other extreme. They differ in the extent of interactivity supported, richness of the material presented, and the extent of asynchronousness supported in time and place.

What does this imply for the role of the professor and the student? One thing is sure that, the days of professors holding sway in a lecture maybe on the decline as universities move to electronic presentations and remote access for students. But are we (the professors) simply doing the same job via a different medium, or is the very nature of the job changing? The answer is yes to both. It is our contention that to a great extent, faculty are doing the same job using the same paradigm but via different medium. The choice of technology is basically governed by the availability of the technology. Missing from this picture is any evaluation of the appropriateness of the technology for the learning objectives that are the real essence of any teaching. The nature of the job itself is changing. Traditionally the role of faculty has been that of content provider, while the function of media design was that of the publisher. In web-based learning, the faculty's role includes that of a content provider as well as media designer where (s)he has to think of how the student accesses and uses the content. It is in this context that the faculty has to evaluate and select from the various options available such as bulletin boards, chatrooms, groupware, real-time video, visualization, animation, etc.

Our focus in this research is Web-based distance learning for Information Systems courses. Information systems (IS) courses require a high degree of interaction between the faculty and students, and among the students. For example, learning a new software application is often accomplished with live demonstration by the professor, instead of the students going through a built-in tutorial by themselves. Also, IS courses require the students to work on projects as a group using complex software such as DBMS, CASE tools, etc., most of which are very expensive for students to buy. How then would we accomplish effective teaching in the distance education courses?

No one technology available today, would be able to meet all of the requirements of the teachers and students. Also, we don't have sufficient knowledge to make appropriate selection of technologies to maximize the quality of distance education.

This paper discusses an ongoing research in Web-Based Distance Learning strategies in a university explicitly mandated by the state to focus on distance learning. In the following sections, we discuss the literature review, the focus of the research and research methodology, and the work done so far; which includes identifying the existing technologies and a framework for classifying the existing technologies, and the survey developed to gather data from information systems faculty and students taking IS courses.

LITERATURE REVIEW

Laurillard published *Rethinking University Teaching* in 1993 to explain effective use of education technology for university education. Then, Leidner and Jarvenpaa (1995) identified factors that affect the effective use of information technology for management school education. Those factors include electronic classroom types, their principle pedagogical assumptions and theories of learning, types of information technologies, and characteristics of students. In this study, they have shown the theoretical relationship among those factors, providing us with a strong theoretical basis for empirical studies. Lawhead et al. (1997) also provided a lesson development evaluation framework for distance learning. The dimensions included in their framework are development cost, delivery costs, student costs, and sustainability and cost-effectiveness. Epstein and Madey (1997) also developed a framework that shows the relationship among factors that determine the appropriateness of information technology for distance learning.

Almstrum et al. (1996) provided a framework for evaluation of technology for Computer Science/Information Systems (CS/IS) courses, indicating tradeoffs among desired evidence, costs, and other constraints for several empirical study approaches and techniques.

Several researchers have conducted empirical studies regarding the effectiveness of IT as an education tool. Hiltz (1994) tested the Virtual Classroom, one of the most famous distance learning tools developed by the New Jersey Institute of Technology. Several empirical studies were conducted to evaluate IT as a supplemental tool for a traditional classroom CS/IS courses (Alavi, 1994; Clark and Scott, 1995; Jankowski, 1997; Randolph, 1997). Effectiveness of video-conferencing was also empirically studied by Alavi, et al. (1995) and Wheeler et al., 1995). Hadidi (1997) conducted an empirical study on interactive conferencing class supplemented by WWW. Hislop (1997) reported student's attitude towards asynchronous learning networks, characterized by their support of "anytime, anyplace" education. In short, those studies show that when IT is used as a supplemental tool to a traditional face-to-face or technology-based conferencing class, the effectiveness of IT support is recognized. Also, positive students' attitude towards IT as an educational tool has been recognized. However, there is some disagreement on the effectiveness of IT as a main educational tool, requiring further empirical studies.

One of the important aspect of the design, development, and delivery of learning is individual differences in learning styles (Sadler-Smith, 1996; Sadler-Smith, 1997). It is believed that characteristics of students affect the efficacy of learning (Anderson, 1993, Knowles, 1990). According to Dunn, Ingraham, and Deckinger (1995), several researchers suggest that matching individual's learning style and teaching method may improve the learner's performance. For example, computer-based collaborative learning may be effective for matured, motivated learners but it may not be true for less motivated and less matured learners (Hiltz, 1988). Sadler-Smith (1996) points out that when a learner's preferences match with the learning methods used, a favorable reaction could result in greater motivation, greater willingness to participate in learning according to Kirkpatrick's framework (1976). However, Leidner and Jarvenpaa (1995) point out that little is known about the prerequisites to the effective application of IT in learning environment. In distance learning, it is important for instructors to know which course module implemented in a specific technology is perceived by students as a better instructional material.

THE RESEARCH

In this section we discuss our exploratory empirical study to identify the latent relationship between the independent variables described below and the appropriateness of the technology for the learning objectives of the IS course modules. These independent variables belong to three dimensions: course module variables, student variables, and instructor variables. Course module variables include: topics of module (which are categorized based on IS97), type of technology used, etc. Student variables include: demographic variables, learning styles, learning environmental preference, etc. Instructor variables include: demographic variables, attitude toward technology as educational tools, attitude toward distance learning, familiarity with technology, etc. Appropriateness of technology is measured as satisfaction level of students and instructors.

Research Methodology

The research is done using survey method, collecting data from two target populations: students who have taken distance learning IS courses; and faculty who have taught distance learning CIS courses. Technologies or tools currently available for distance learning have been identified through literature review, and web searches.

Existing Technologies

We identified technologies used in distance learning by searching the existing literature (including journal and conference articles in the CIS and Distance Education fields) and the Internet (including distance course pages posted by universities and colleges, distance learning research pages, and software vendor pages). Many companies or universities implement the same technology as a specific product. Furthermore, a specific product often integrates several generic technologies. To generalize specific products implemented by a specific organization to generic technologies, we needed to apply a taxonomical framework. We used four criteria adopted from Hartley et al. (1996) to achieve this. Those four criteria are:

Type of communication (Hartley et al. Called this 'Uses')
- One-to-one
- One-to-many
- Many-to-Many

Time dimension on the delivery of educational contents (level of time-independence)
- Synchronous
- Asynchronous

Richness (Type) of Media Supported
- Text
- Audio
- Graphics
- Animation

Level of interactivity supported by technology
- Read-only
- Simple interactive
- Complex interactive
- Human interactive
- Intelligent/targeted tutorials

After we generalized specific products to more generic technologies, we grouped them using the same criteria for the purpose of developing a questionnaire. The technologies we identified are shown below. Some technologies appear in more than one category, because one technology could be used in many ways.

Category 1: 1 to 1 (Personal) Communications
Plain old telephone system
Internet telephony
e-mail (with Attachment)
Fax

Category 2: 1 to Many Single Media Communications
Audio publishing (Tape) and audio streaming
Hypertext
e-mail (withAttachment)

Category 3: 1 to Many 1-way Multimedia Education/Teaching
Business television (BTV)
Cable and public television
Videotape
Full motion video
Compressed video
Hypermedia
Tutorials
Video on WWW and streaming
Animation
e-mail attachment

Category 4: Educational Software
CD-ROM
Video disk
Computer-aided instruction
Tutorials
Visualization software
Virtual reality

Category 5: Testing and Evaluation
Hypertext

On-line quiz
Computerized grading

Category 6: Multimedia Discussion
Audiographics
Videoconferencing
Desktop videoconferencing
Application/File sharing
Web-enabled application software
Groupware
Whiteboard (graphics conferencing)
Web-enabled CASE
Web conferencing

Category 7: Single-media Discussion
Audioconferencing
Chatroom
Electronic bulletin boards
Whiteboard (graphics conferencing)
Newsgroups
Mailing lists (e.g. listserv)

Category 1: 1 to 1 (Personal) Communications: This type of technologies/tools mainly supports communications between an instructor and individual students synchronously or asynchronously.

Category 2: 1 to Many Single Media Communications: This type of technologies/tools mainly helps an instructor provide information (announcement/lecture summary) to many students. This type of technologies/tools supports only single media such as voice only, text only, or image only. This type of technologies/tools does not allow synchronous interaction between participants.

Category 3: 1 to Many 1-way Multimedia Education/Teaching: This type of technology/tools mainly helps an instructor provide information (lecture) to many students. This type of technologies/tools supports multi-media such as a combination of voice, text and image. This type of technologies/tools does not allow synchronous interaction between participants.

Category 4: Educational Software: This type of technology/tools mainly help students learn the materials by interacting prepackaged software. This type of technologies/tools usually supports multi-media such as a combination of voice, text and image.

Category 5: Testing and Evaluation: This type of technologies/tools is primarily used for evaluating students performance.

Category 6: Multimedia Discussion: This type of technologies/tools supports communication, especially discussions, among participants synchronously and asynchronously. This type of technologies/tools supports multi-media such as a combination of voice, text and image.

Category 7: Single-Media Discussion: This type of technologies/tools supports communication, especially discussions, among participants synchronously or asynchronously. This type of technologies/tools supports single media such as voice only, text only, or image only.

Survey of the IS Faculty

Once the available technologies were identified and categorized, we then determined the course modules that were of interest for us in this research. Since there is a wide diversity on the IS courses offered by various universities, we have decided to select the list of the relevant courses from IS'97. IS'97 is a model curriculum for undergraduate degree programs in Information Systems. This curriculum is the result of the joint effort of ACM, AIS and AITP, and is endorsed by DSI, IAIM, SIM, IACIS and INFORMS-CIS. The course modules that were identified are:

1. Fundamentals IS/Personal Productivity
2. IS Theory & Practice
3. IT Hardware and Software
4. Programming, Data and Object Structures
5. Network & Telecommunications
6. Analysis & Logical Design
7. Physical Design & Implementation with DBMS
8. Physical Design & Implementation with Programming Environment
9. Project Management & Practice

The third activity involved in the survey development was identifying the learning outcomes and purposes for which a technology is used for the faculty. This list was created as result of the brainstorming of the authors and is based on the factors identified by Leinder and Jarvenpaa (1995). The list is shown below:

- To control pace and/or content of learning
- To disseminate knowledge
- To make course related announcements
- To substitute for classroom lectures
- To substitute for lab assignments/demos
- To facilitate students to create knowledge
- To motivate students and increase their interest
- To achieve conceptual/procedural learning

- To increase participation/attention/discussion
- To have students work on assignments
- To conduct testing and grading
- To provide students with feedback/help
- To encourage collaborative learning
- To have students make presentation

The final survey which is shown in appendix A (and is also available on the WWW at http://www.fgcu.edu/knakatan/webeducation/websurvey.html), seeks the participants responses on two aspects. First, if the participant has used technologies in a specific technology category, for a specific course for a specific learning outcome/purpose. The second aspect seeks to find the participant's perception of the appropriateness of a specific technology category, for a specific learning outcome, for a specific. At this time we are still receiving responses from the participants, and we welcome other IS faculty to participate in this study by visiting the web at http://www.fgcu.edu/knakatan/webeducation/websurvey.html.

Survey of the Students

A similar exercise was conducted to design and gather data from the students who have taken courses offered by a Computer Information Systems department. The courses involved were Introduction to Computers (one was a regular class room section and other was an Internet-based section), Database, Systems Analysis and Design. The survey for all the students has two parts: The first part determines the personal learning style preferences. This is common to all students and is based on the work done by Dunn et al. (1982). There are several competing learning theories and no one model has been universally accepted (Bostrom, Olfman, and Sein, 1990). Learning style can represent a very broad concept and individual's learning style can be measured using a variety of instruments. Those include: Learning style Inventory (Dunn, Dunn, and Price, 1975, 1979, 1981, 1985), and PEPS (Dunn, Dunn, and Price, 1982). Learning style inventory is design for grade school students and PEPS is designed for adult learners. According to Dunn et al. (1995), reliability and validity of PEPS was established by several studies (Kirby, 1979; Buell and Buell, 1987; Ingham, 1991; and LaMothe, Belcher, Cobb, and Richardson, 1991). The second part seeks to determine the students' perception on the appropriateness and usefulness of technologies utilized during the class. Since different technologies were employed in the different sections, this part of the questionnaire differs according to the section. A sample survey form is shown in appendix B.

RESULTS

This research on completion is expected to result in:

1. A comprehensive list of technologies currently available for distance learning.
2. A list of factors to be considered when you design distance learning course for Information Systems.
3. Appropriate and inappropriate match-up between tools and course modules measured in terms of perceptions by instructors and students.
4. A list of characteristics of students which are more suitable or unsuitable for distance learning. This can be used to educate students so that they can succeed in distance learning environment.
5. A list of characteristics of instructors which are more suitable or unsuitable for distance learning. This can be used to educate or train instructors to be successful teachers.

SIGNIFICANCE OF THE RESEARCH

The research contributes to academia by empirically identifying factors to be considered for theory development in distance learning course design. This is critical to conduct theory-based research in evaluating appropriateness and cost-effectiveness of information technology as an education tool. The research also contributes to practitioners (instructors and software developers) by providing a framework that can be used as guidelines when they design courses or design computerized software tools for distance learning.

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APPENDIX A

SURVEY OF WEB-BASED/DISTANCE LEARNING TECHNOLOGIES/TOOLS FOR IS COURSES

Please fill out one survey form for each course you are currently teaching or have taught in the past. For each form (course), please do the following:

1. Select the course module (from the list given) which closely matches your course and circle it. These course modules are defined in IS'97. Please refer to an enclosed sheet for brief descriptions of each course module.
2. Circle (a) tool(s) you used listed for each technology/tool category. If you used any technology/tool that is not listed, please specify.
3. For each technology/tool category, check the "Used" column if you actually used this category of technology/tool for the listed learning goals/purposes. If you used it for other learning outcomes/purposes, please specify.
4. Then, for each technology/tool category, evaluate the level of the appropriateness to achieve the listed learning outcomes/purposes. Choose your responses from Highly Appropriate (HA), Appropriate (A), Neutral (N), Inappropriate (I), and Highly Inappropriate (HI). Please do this for all of the listed learning outcomes/purposes.

We have also enclosed a sample survey to provide clarification in filling out the survey form.

IS Course Modules	1. Fundamentals IS/Personal Productivity	6. Analysis & Logical Design
Circle one course	2. IS Theory & Practice	7. Physical Design & Implementation with DBMS
(The course modules correspond to IS 97 model curriculum)	3. IT Hardware and Software	8. Physical Design & Implementation with Programming Environment
	4. Programming , Data and Object Structures	
	5. Network & Telecommunications	9. Project Management & Practice

Technology/Tool Category	**Learning Outcomes/Purposes**	**Used**	**HA**	**A**	**N**	**I**	**HI**
Category 1:	To control pace and/or content of learning						
1 to 1 (Personal) Communications	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
Plain old telephone system	To substitute for lab assignments/demos						
Internet telephony	To facilitate students to create knowledge						
e-mail (w/ Attachment)	To motivate students and increase their interest						
Fax	To achieve conceptual/procedural learning						
Other: ___________	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						

Category 2: **1 to Many Single Media Communications** Audio publishing (Tape) Hypertext e-mail (w/Attachment) Other: ____________	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						

Technology/Tool Categoryê	Learning Outcomes/Purposes	Used	HA	A	N	I	HI
Category 3: **1 to Many 1-way Multimedia Education/Teaching** Business television (BTV) Cable and public television Videotape Full motion video Compressed video Hypermedia Tutorials Video on WWW Animation e-mail attachment Other: ____________	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						
Category 4: **Educational Software**: CD-ROM Video disk Computer-aided instruction Tutorials Visualization software Virtual reality Other: ____________	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						

BEST COPY AVAILABLE

Category 5: **Testing and Evaluation** Hypertext On-line quiz Computerized grading Other: ______________	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						
Category 6: **Multimedia Discussion:** Audiographics Videoconferencing Desktop videoconferencing Application sharing Web-enabled application software Groupware Whiteboard (graphics conferencing) Web-enabled CASE Web conferencing Other: ______________	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						

Technology/Tool Categoryê	Learning Outcomes/Purposes	Used	HA	A	N	I	HI
Category 7: **Single-media Discussion** Audioconferencing Chatroom Electornic bulletin boards Whiteboard (graphics conferencing) Newsgroups Mailing lists (e.g. listserv) Other: ______________	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						

STOP HERE

THANK YOU VERY MUCH

APPENDIX B

A sample student survey form

	Questions: In-Class Course	Strongly Agree	Agree	Neutral	Dis-agree	Strongly disagree
Syllabus and Announcement						
1	Providing **Syllabus** on the course web page (HTML file), in addition to handouts, was useful.					
2	I like the fact that **Syllabus** was available on the course web page (HTML file) in addition to handouts.					
3	Course Web Page (HTML file) is appropriate for delivering the **Syllabus**.					
4	Providing **Announcements** on the Web Board, in addition to announcements in class, was useful.					
5	I like the fact that **Announcements** were provided on the Web Board, in addition to announcements in class.					
6	Web Board is appropriate to make course **Announcements**.					
Notes / Clarifications						
7	Providing **Notes** (which explain "how to" use the software) as Acrobat files (pdf files), in addition to in-class lectures, was useful.					
8	I like the fact that **Notes** (which explain "how to" use the software) was available as Acrobat files (pdf files), in addition to in-class lectures.					
9	Acrobat files (pdf files) are appropriate for delivering **Notes** (which explain "how to" use the software)					
10	Providing **instructions** (which explain "how to" use the software) as Microsoft Camcorder files, in addition to in-class lecture, was useful.					
11	I like the fact that **instructions** (which explain "how to" use the software) was available as Microsoft Camcorder files in addition to in-class lectures.					
12	Microsoft Camcorder files are appropriate for delivering **instructions** (which explain "how to" use the software).					
Homework						
13	Providing **Homework Assignments** on the course web pages, in addition to handouts, was useful					
14	I like the fact that the **Homework Assignments** were available on the course wen pages in addition to handouts.					
15	Course Web pages are appropriate for delivering **Homework Assignments.**					

THE MIS CAPSTONE: DEVELOPMENT ON AN INTEGRATING GROUP APPLIED PROJECT COURSE

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Johns Hopkins University, SCS

This paper discusses the development of a MIS Capstone course in an adult graduate information technology program. Rather than focusing on a technology topic, the course provides an environment that allows students to apply the information and skills that they have obtained in the program. Teams of students work with an organization and deal with actual IS issues in a real world environment. Students start with a discussion of issues with their corporate sponsor and develop a scope statement to define the project. They finish by producing the deliverables specified in the scope statement and submitting a detailed written report. This paper describes the various elements of the course, the tasks required to ensure completion, time requirements, and faculty issues. Initial results indicate significant improvement in student understanding of important IS issues, evaluation of the course, and student satisfaction.

INTRODUCTION

The effectiveness of communicating global MIS and business concerns to technical students has on the whole been poor. A survey of academic journals and popular literature reveals numerous articles describing various education programs and their efforts to better prepare MIS students to function in the corporate business world after they graduate. The articles generally indicate that there is a problem accomplishing this at many schools. Student exit surveys indicate that many students, especially those changing careers, although technically competent, do not feel confident about their abilities to function in an IS role.

BACKGROUND

Chow and Edmundson (1994) discussed what IS employees lack from the employers' standpoint. Articles continue to mention shortcomings and limitations of graduates (Alexander, 1996, Coffee, 1998). In a recent issue of *Information Week* an article by Marianne McGee (1998) discussed the disconnect common in MIS programs between what industry wants and needs, and what is typically provided. The article notes the apparent inability of many MIS programs to produce graduates who are ready and able to meet the demands of dealing with a highly technical integrated infrastructure supporting multiple functional departments in organizations across our information society. This is not a new complaint. Buckingham (1987) discussed many of these same issues over a decade ago.

Interviews with local IS professionals and business executives confirmed many of the problems described above with their employees. They identified the same general skill sets beyond basic technical competency that Herman (1994) and others feel an effective MIS program must give its students. First, students must have skills necessary to function as part of a group. Second, students must have good oral and written communication skills. Third, they must have the ability to develop useful systems that provide functional managers the information that they need. It is obvious that one course can not cover all of these issues, but it can expose students to the environment and provide practice in developing these skills.

Course Development

The present paper only deals with one aspect of these issues, the preparation of students with experiences to aid in their success in the workforce. A survey of web sites of several MIS programs revealed that twenty-three of the thirty reviewed have some sort of capstone course/experience in their programs. The course was typically described as one that provides the student with a chance to integrate knowledge learned in a variety of courses across the curriculum. Fourteen of the twenty-three made use of an individual independent study project which might or might not involve working with a real organization. Several of the others were linked to some sort of case approach, and one had multiple teams work on a single project.

At our school, the MIS program had been taught for three years without anything resembling a real capstone course. Several different approaches were tried, but none seemed to really achieve what was wanted. In the spring of 1997 we finally were able to develop a course that accomplished what we wanted for our students. Using the ideas mentioned above and information contained in Quarstein et al (1994) and Richards and Pelley (1994), several points were identified during the course design phase and incorporated in the course description.

The new course would be an applied project class, so students could have the experience of working on an IS related undertaking with a real organization. Since it was based on an applied project, no specific technology topics or issues would be taught. It would also be a group activity. Most MIS projects are done in groups, and students must learn to effectively function in a group environment. Also, since almost all of our students are working with full time jobs, it ensures that the project can continue even if a team member is called out of town on business trips. Lastly, a group allows a larger scope project to be accomplished. The class projects are significant undertakings, which could not normally be accomplished by a single person in a one-semester time frame. No project for example is as simple as, 'design and implement a web page.' Appendix A is a listing of some completed projects.

The following description was developed based on these ideas.

> This course is intended as the culminating experience in the MIS program. As such, it is taken in the student's last semester. This course provides a guided experience, which which will help students to manage information or telecommunication system projects in the future. It provides students an opportunity to participate in actual technology projects within a real work environment with all its processes and challenges. Under the supervision of a faculty advisor, student teams develop a project proposal.
>
> Utilizing the skills and knowledge gained in the program, project teams then design, develop, and/or implement a telecommunications or information system solution for the organization.

Various desired outcomes were also identified. By the end of the course the students will be able to:

1. Demonstrate meeting and project management skills while meeting with technical and non-technical staff.
2. Determine the real underlying IS problems and/or needs of the organization.
3. Research the corporate sponsor's industry and demonstrate a working knowledge of the best business practices in this industry or business, particularly in the project's content area.
4. Analyze current business practices/processes within the corporate sponsor's organization.
5. Gather and analyze pertinent data about the project.
6. Document the approach and techniques used to solve the business problem.
7. Demonstrate use of good documentation standards to support research, findings, and analysis in the corporate and academic reports discussing the project.
8. Use electronic presentation methods to communicate project progress and obstacles.
9. Demonstrate appropriate team building skills to work cooperatively in assigned groups to complete the project.
10. Demonstrate analytical and problem solving skills in solving the business problem, addressing a changing business environment, and meeting the client's expectations.

A syllabus was developed that focused on these outcomes and identified several specific enabling tasks and objectives. Students will:

1. utilize systems analysis and design methodology,
2. apply content specific skills and knowledge learned in the MIS degree program,
3. quickly organize themselves to address the specific technology project proposed by the corporate sponsor,
4. quickly learn the industry to which they are assigned and the businesses processes involved,
5. identify and negotiate a scope of services statement,

6. apply a proven methodology to address the agreed upon business problem,

7. analyze and evaluate alternative solutions,

8. propose sound and reasonable, creative recommendations,

9. implement recommendations, if appropriate,

10. document business processes and customer requirements,

11. evaluate accomplishments of the project.

COURSE OPERATION

One section of the course is offered each term at each program center, and students register for this course as they would any other course in the program. Typically there are at least three sections taught each term. The only special characteristics of the course are that it must be the last course taken in the program, and that the enrollment cap is 24 students with a preferred class size of 20 or less. Students must petition if they wish to take another class the same term to complete their course of studies.

Prior to the term students take the course, Information Technology (IT) Department staff use a variety of means to contact organizations and companies in the local area about any IS type projects or tasks which these firms might have. Individuals and organizations also can contact the department with suggested capstone projects as well. See appendix B for the project request form. Before classes convene a list of participating organizations and companies with the expected projects is sent to all instructors.

On the first night of class, the list of participating organizations and companies with the types of projects available for the term is given to the students. The instructor discusses the various projects and the participating firms with the class. Students then are given time to discuss projects and possible teams. At the end of the evening, students select their top three choices for projects based on interest, experience, and skills.

The instructor then assigns students to projects, using their choices as a starting point. He/she must make sure that all projects get a balanced team to work on them, and that proper-sized teams (4-5 students) are formed. Team makeup is critical for project success. If the team is made up of individuals with a limited mix of skills, the process is often less successful than it could have been. Projects and companies often vary widely in their appeal; as a result there is usually at least one project chosen by few students, and one that is chosen by most students. Final team assignments are based on student skills and competencies as recorded on their Skill and Preference Form. (appendix C). As a result of all these constraints, only about 70% of students get their first or second choice for a project.

There is some flexibility about team assignments. If after initial team assignments have been made, a student wishes to be on a different team, they can switch if they can find someone to replace them on their original team. After the teams start working, students can be fired from a team, if the team feels that they aren't performing. Students also have the option to quit a team, if they feel the team isn't doing its job. In these cases students can try to get hired by another team, can attempt to complete a project on their own, or can take an incomplete grade and repeat the course the following term. This is obviously a serious problem, and if it occurs late in the term almost guarantees that the fired student will not complete the course that term. The faculty advisor and the course instructor both work with the team leader and team members to resolve such problems. As a result of these efforts, this has occurred only twice in eighteen classes with over 300 student enrollments.

After students have their final team assignments, they meet as a group with their faculty advisor and identify a team leader who serves as the team point of contact for both the corporate sponsor and the course instructor. One of the main purposes of this first meeting is to show students that while individually there may be some gaps in their technical knowledge or experience, as a group their knowledge and experience level is quite high.

Team members compose a list of questions that they want answered about the company, project, industry, etc. The team leader schedules a meeting with a representative from the company who becomes the team's corporate sponsor. The team meets at the company with the faculty advisor and the corporate sponsor. This can be an eye-opening experience for many students. The response to the questions developed by the team often shows that the sponsor does not have a firm understanding of the requirements, time required, and general work issues that are necessary to complete what they want. In spite of this confusion, during this first meeting with the sponsor, the team must find out as much as possible what the requirements and expectations for the project really are.

After the meeting with the sponsor, the team assembles again to develop an initial scope statement which outlines in some detail the work involved, timing, deliverables, etc. At this point many projects change focus from what was originally identified.

At the next course session, the class as a whole discusses each project, as defined by the scope statement and presented by team members. All class members discuss or question what should or could be done in each of the projects and help to refine the scope statement. There is also considerable collaboration between the groups. Class members from one team will often offer to assist other groups if a particular team has no one with required knowledge of some technology or application. As a result of this collaboration, the level of quality and detail in project deliverables is markedly improved. During these discussions, students also learn that many organizations have similar problems, that functional managers often have little knowledge about Information Technology, and that there is great benefit in working as teams in projects.

Each team then rewrites their scope statement based on input and recommendations from the class and meets again with their corporate sponsor to get it approved. This document becomes their contract with the corporate sponsor. If either the sponsor or the team wants to modify the project after it is signed, a new or modified scope statement must be prepared, and both groups must sign it.

After the scope statement has been approved, one of the first tasks the team must complete is to obtain in depth knowledge about the company, the industry, the type of technologies used, software and hardware used, and alternatives pursued by other companies. This research is partly accomplished through the writing of individual research papers. The instructor assigns each team member a specific topic to research, and they must complete this paper by the 8th week of the course. The purpose of the paper is two fold. First, it ensures that collectively the student teams have done sufficient research to know the industry, understand major issues and concerns to be able to provide a valid solution for the organization. Second, it provides a chance for the instructor to help hone the writing skills of individual students before they graduate.

Based on their meetings with the corporate sponsor, knowledge learned in the program, their own research, and the scope statement; the student teams then work with the corporate sponsor as required to complete the project in the fifteen week semester time frame. Their goal is to develop the best IS solution, given their knowledge of the organization and its problems.

The last night of class students make their presentations to corporate sponsor IS and management staff, IT faculty, the rest of the class, relatives, and interested guests. This presentation is expected to be highly professional, providing discussion of the problem, relevant research, alternative analysis, and a recommended solution.

Project teams also must prepare reports that discuss the entire project from problem statement to solution. One element of the report is a discussion of what went right or wrong in the project. Often the teams identify issues such as preconceived solutions or directed solutions on the part of the corporate sponsor as major problems. In some cases there is a difference between a best theoretical solution and one that would be accepted by the company. Some highlight great success stories. One sponsor wanted what they thought was a problem solved, and the students found a major underlying flaw in their systems which, when corrected, solved the perceived problem. In another case an organization had made a preliminary vendor selection for a project, but there had been no consideration of implementation and ongoing technology costs. The project team completed this analysis and a different vendor was selected.

GRADING

As with any course grading is an issue for students, and many graduate students do not like group projects. To minimize student issues and concerns about grading, several elements were included in the grading. First, there is the individual research paper worth 20% of the course grade. A person who writes a poor paper can receive a letter grade different than the rest of their team, if everything else is equal. Second, the course instructor, faculty advisors, and team members all evaluate individual team member performance. These evaluations account for another 20% of the course grade. They consider how the individuals perform with the group, which ones do the work, who does the best work, who is divisive, who doesn't show up, etc. As a result even though the overall project is group based, 40% of the grade is dependent on individual performance. This approach has eliminated most of the complaints that group grades are not fair.

The remaining 60% of the course grade are composed of group grades for the scope statement, an interim written report, an interim oral presentation, the final written report, and the final oral presentation. These deliverables are due at various times throughout the term, and this allows students to know how well they are doing as the course progresses, which reduces the concern for a single grade at the end of the course.

Administrative Issues

This course is very labor intensive for the instructors. They need support from faculty advisors and corporate sponsors. Some of their main responsibilities are described below.

Course Instructor

- Facilitates the in class sessions, encourages interaction of teams and uses class resources to help project teams.
- Provides project management oversight direction and works with faculty advisors to ensure that all class projects progress.
- Works with corporate sponsors to ensure that required information is provided to teams in a timely manner.
- Identifies and assigns topics for the individual research papers.
- Acts as faculty advisor for at least one project.
- Rates performance of all teams and gives feedback for improved performance.
- Evaluates individual research papers, scope statements, interim and final reports.

Faculty Advisors

- Provide guidance to team members on (a) technical issues that arise in discussion with corporate sponsor and (b) process issues that arise during all phases of project design and implementation.
- Observes students in team meetings, records observations, and submits a final evaluation of team and individual contribution.
- Communicate with course instructor on any unusual challenges or project implementation issues or process problems with team members.
- Evaluate student projects from technical and process perspective.
- Meet with teams as appropriate, particularly during project scope of services development and the final meeting with the corporate sponsor, other times as requested by the team members.
- Attend interim and final team presentations and the formal presentation to the corporate sponsor.

Corporate Sponsors

- Appointed contact who acts as corporate project liaison for the team.
- Provide access to users and data the team needs to deliver services agreed upon in the scope of service statement.
- Be accessible to respond to team member questions and follow up communications in a timely manner.
- Attend final presentation.

Project Issues

At first it was difficult to develop the required number of appropriate projects. We use between 15 and 18 each term, so in a little over one year, we have completed 91 different projects. It is getting a little easier now. Some companies have heard about the projects and want to get involved. Many firms recognize the quality and amount of work done. As a result, we are starting to have requests for follow on projects, or in the case of some large companies, more than one project in a term.

A continuing problem is the need to screen the projects to determine their suitability. Some of the obvious constraints are that they can not be mission critical, time critical, involve extended time frames, involve travel to distant locations, or be merely an implementation of some technology at the technical level. Although the IT staff talk to the organizations on several occasions, there is always at least one surprise when the students arrive. Sometimes when the students meet with the corporate sponsor the project turns out to be too much, too little, too controlled, etc.

The workload varies between projects and there is usually no way to predict this completely in advance. All require significant amounts of work outside of class and meetings on site with the corporate sponsors. Typically a company who has sponsored a project before has a better feel for what we can do and what they need to provide. As a result students may only need to meet with the sponsor on site three or four times during the term. For others it may require weekly meetings to make sure the team and sponsor keep in tune with what is going on. If there is some technical implementation required, it may take multiple meetings per week to resolve and complete the project.

While much work on the projects can be done using information available from library sources and the Internet, a key element in many projects is information about the company, its operations, goals, technologies, etc. Student and faculty advisors sign non-disclosure statements, and many companies are very forthright about providing company information. Others make students work in the dark, and then complain about the results. Some companies ignore project deadlines so students are in the 11th week or later still waiting for key pieces of information. This can be a company problem or a sponsor problem, and must be resolved quickly by the course instructor, if the project is to be successful. If a company comes back with a second project, these are not significant issues.

Course Evaluation

After the initial offerings of the course, student exit questionnaire comments were reviewed. It asked about their feelings concerning the need for the course, their level of knowledge of IS, the need for functional managers to have knowledge of IS, and finally the value of IS to organizations. The majority of student answers are more positive than previous classes that had not been involved with the capstone course. This seems to indicate that learning has occurred at several levels, even though those topics are not addressed directly in the course. At this time there had been no statistical analysis to determine if these differences are significant.

RESULTS

Students receive first hand knowledge of issues which face IS personnel in companies. Students have seen:

a. company politics, for example, 'look at this problem but pick Lotus notes';

b. changing directions, a new department head arrives and sees no need for project;

c. need for a scope statement, when the corporate sponsor quits for better job or is fired, and someone else takes over the project;

d. lack of support for IS in the organization

e. lack of knowledge of IS that leads sponsors to suggest projects that would take several man years to complete, just to name a few.

Students also learn that projects in large technical companies are often more constrained than projects in smaller or not technically based organizations. Many students who really wanted a project with a particular company because of their national presence found out the bureaucracy and politics made doing anything meaningful almost impossible. Other students working with smaller companies have worked with corporation CEOs, Chairmen of the Boards of Directors, CIOs, and have found that high level management interest does much to ease information gathering, meeting deadlines, and general project support.

So far this course format seems to be very successful. In the five terms that it has been offered students, organizations, and instructors have all voiced views that this is truly a unique and valuable experience. The net result is students now look forward to the experience and are calling a term or two in advance to find out what some of the projects might be.

CONCLUSIONS

It appears, that at least for our student population, the capstone group applied project course significantly improves the learning experience. At its completion, students feel that this is not a book exercise, and see that the real world is not as clean and neat as many texts say it is. Most realize the major role that functional managers must play in the development of new effective MIS solutions and the requirement for IS personnel work with them.

Many students dislike the course while it is being completed because of its extensive requirements, but after completing the course, students generally note it as one of the high points of the program. Although the course description says that students will not be learning anything about technology per se, all students agree that the course is a good learning experience. A large number discuss the technical information that they learned as well as the skills they learned to work effectively in an IS role. Most comment that one of the biggest benefits was exposing them to some common problems involved in working in IS.

An unexpected benefit of the class has been that it has provided an entrée for students into companies. Although our students are normally fully employed and not looking for jobs, some students have been offered jobs or consulting positions based on their work in these capstone courses.

The course is not a panacea. As developed, it works well with non-traditional working adults who are focused in their desires to receive a degree. While students completing a full time day program would have an easier time setting up meetings and going to the corporate sponsor site, their lack of current job experience might limit their flexibility and creativeness in dealing with the ambiguities associated with working in a consulting role. Also some undergraduate students might not have the focus to be willing to spend the hours necessary to complete a project that requires extensive time commitments over what was originally envisioned to bring about its successful completion. Finally, depending on the maturity level of team members, the faculty advisor work load and instructor workloads might be significantly increased to ensure that the final product does credit to the program and/or school reputation.

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APPENDIX A

The projects completed include a wide range of tasks including:

1. Developing an IT plan for a non-profit organization addressing issues of email, Internet presence, staffing, training, and LAN development.
2. Development of a client server database for a police department. System was windows based on an Ethernet LAN with security at data element level
3. Develop plan for second-generation architecture for an ISP including network design, software, and server selection.
4. Plan and development of a corporate Intranet for a human resources department of a large national company. Included the design of dynamic web pages to ensure easy update of information.
5. Plan for initial move of small company into electronic commerce; include design of web pages, content selection, determination of commitment level, and evaluation competition moves in EC.
6. Work with a chamber of commerce to develop geographic information systems to address issues of growth and development in the county.
7. Develop an online notification for users of an electron commerce provider.
8. Analyze and recommend third generation database for an insurance company after reviewing need requirements and legacy systems.
9. Automate loan generation and administration process for an entrepreneurial fund.
10. Design and implement an online advising system for university program advisors.

11. Work with a medical Services Company to establish electronic communication systems for physicians.
12. Design and install a LAN for small non-profit org.
13. Assess value and make recommendation on vendor for implementation of an Internet banking option by a small financial org.
14. Identify and develop specific technology requirements and a recommended solution in designing the next generation insurance agency.
15. Design web site and plan to link LAN to Internet and develop security steps to protect the main system for a company.

APPENDIX B

These forms are on the web site, passed out to students in the capstone courses, and are available at all of the teaching centers.

Technology Capstone Suggestion Form

The IT Department is always looking for organizations to be used in its IT applied capstone project course. This course allows teams of students to work with an organization to investigate an IS issue or solve an IS problem. The major requirements are: 1) The company must be using technology in its operations and want to improve this operation. 2) The company must have a willingness to allow non-employees to look at various company operations and activities. A team of experienced students will devote approximately three months to these projects, which are the culminating experience of students in the Masters of Information and Telecommunications Systems.

If you have a project in mind for a future Technology Capstone, please fill out and submit the form below. The information provided will be followed up and explored for possible selection. Please fill out the form as completely as possible.

Potential Sponsor

Company Name:
Address:
Contact's Name:
Contact's Phone Number
Contact's email
Contact's Title:

Project Description:

Please give a brief description of the project you are proposing. The description should give a clear overview of the project with enough details to convey the main idea. Expected scope and time constraints should be included.

Submitter Information:
Please provide a means for contacting you about your suggestion.
Name:
Address:
Voice:
Email:

Return to Carol Keyser, JHU School of Continuing Studies, Business and Management Division, Information Technology Department, 201 North Charles St. Suite 200, Baltimore, MD 21201-3933. Voice (410-516-0778), fax(410-659-8440), email (ckeyser@jhu.edu).

APPENDIX C

Student Skill, Data and Project Preference form

1. Name:

2. Day Phone:( )

3. Evening Phone (Optional):

4. email:
5. fax#:
6. Academic Concentration:
7. Work Organization:

8. Relevant Experience:

Project Management:

Yes _____ No_____ Some_____None_____

System Development Life Cycle:

Planning_____Analysis _____ Design _____ Development _____
Implementation_____ Maintenance_____

9. Tools:

Project Management /scheduler:

Other:

Internet Experience: HTML___Front page___Search engines only___ No Experience__

10. What skill sets do you bring to the project?

____

____

11. What are your expectations for this course?

12. Project Preferences (Which Project interests you and why?) Give order of preferences and use the back of this page.

MAKING PROJECT GROUPS WORK II: THE IMPACT OF GROUP PROCESS TRAINING AND ROLE ASSIGNMENT ON THE PERFORMANCE AND PERCEPTION OF INFORMATION SYSTEMS PROJECT TEAMS

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Many project teams in organizations are highly structured, members have clearly defined roles, and they possess knowledge about how to effectively manage their projects and meetings. On the other hand, students in educational environments lack significant experience working in teams. Therefore student teams are often poorly structured, members commonly have difficulty developing functional roles, and communication and coordination problems persist. We demonstrated the impact of these problems by interjecting two interventions in student project teams: 1) training on group process and 2) the role assignment. The results of a controlled experiment show that both interventions had positive impacts on student project teams. Team members that were assigned roles reported higher cohesion and produced higher quality projects than did team members in the control group. Furthermore, cohesion and project quality was highest in teams that received both training and role assignments. A discussion of the findings and implications for future research are presented.

INTRODUCTION AND LITERATURE REVIEW

Project teams are increasingly being used as the fundamental organizational unit for managing information systems development projects as well as a variety of other types of projects (Busch, Hamalainen, Suh, Whinston, & Holsapple, 1991). Teams add value because they are flexible (e.g., the small size of a team enables its members to respond quickly), they are fluid (e.g., membership can be changed in response to internal and external pressures), and they are often more effective at managing large projects (e.g., by bringing together team members with a variety of skills appropriate for the project). Therefore, many educators have incorporated student project teams into a variety of courses (Butterfield & Bailey, 1996; Jones, 1996).

In spite of the importance of teams to organizations, our experience suggests that students often dislike participating in project teams. What is it about project teams that students dislike? Steiner (1972) and others (Larson, 1989; McKinney & Graham-Buxton, 1993; Sadler, 1994; & Yamane, 1996) have suggested that there are extra costs that are involved in working together in teams. For example, when completing a project alone, a student must only engage in whatever activities the project requires. In a simple sense, the activities, or work, required to complete the project is equivalent to the cost the student must pay to achieve success. However, working in a team adds costs to the process of completing the task. A significant part of these additional costs are related to the transaction costs involved in engaging in group work (Yamane, 1996).

Transaction costs are those costs that arise because group members must spend time and energy communicating ideas and coordinating activities. There are many steps in the communication process where transaction costs can be compounded. For example, to communicate, a message must first be encoded by the speaker and then transmitted to the recipient(s). The recipient(s) of the message must be able to receive the message and then decode its meaning. Throughout this process, there are opportunities for the communication to be corrupted, misunderstood, or lost. When this occurs, misunderstanding will occur which will either lead to problems with coordination or to a need to communicate the message again. In either case, these types of communication problems lead to greater costs for the group members.

A second cause of transaction costs relates to the overhead associated with coordinating group activities. To carry out their activities, group members must schedule times for meeting interactions, allot time for these meetings, and communicate information about the agenda for meetings. In the context of student project teams, these activities involve the coordination of meeting times around student classes, extra-curricular activities, and work schedules. These coordination tasks, in particular, can be quite difficult for students to deal with because members of project groups are often assembled by the instructor in an ad hoc fashion or students self select their groups without considering their schedules or other potential conflicts.

Many of these problems are exacerbated by the fact that students lack experience with working on formal projects in structured group settings. For example, the average businessperson spends many hours per week in meetings (Panko, 1992). In general, these meetings are well structured, an agenda is set and published prior to the meeting, events and conversations occurring during the meeting are documented in the meeting minutes, and members of the meeting have defined roles. Furthermore, many people in organizational teams have significant experience with and, in some cases, training about topics such as meeting management, team processes, and conflict resolution.

Because most students do not have significant experience with meetings they are likely to have many more problems in their team meetings than would experienced members of organizational project teams. Therefore students often suffer from increased process losses associated with team coordination and role ambiguity. This raises a set of important issues for educators. For example, how can we provide students with guidance and interventions that will assist student teams in reducing transaction costs? In a study designed to examine this issue, Mennecke and Bradley (1997) introduced to their student teams an intervention consisting of role assignment. They found that members of student teams that were assigned roles had higher cohesion and produced higher quality projects than did members of teams without assigned roles. Thus, a very simple intervention was shown to help students improve their performance and their feelings about their teams. This raises the question, "What other interventions might help student project teams to function more effectively?"

One important issue for student teams is the lack of knowledge that many students have about issues like improving team processes, resolving conflict, and fostering beneficial leadership behaviors. Therefore it is possible that providing students with training on these issues would help them to function more effectively. To examine these issues, we performed a research experiment to identify whether student teams would benefit from two interventions: 1) role assignment and 2) training in group processes. Because knowledge about group processes was expected to be more beneficial to groups than role assignments alone, we expected that teams receiving this intervention would outperform all other groups. In addition, as shown by Mennecke and Bradley (1997), students receiving role assignments alone should also be expected to outperform student teams with no interventions.

The next section describes the methodology used in the study. This is followed by a description of our results. The paper concludes with a discussion of the findings and implications for teaching and further research.

RESEARCH METHODOLOGY

Independent and Dependent Variables

This research was designed to assess the impact of assigned roles and group process training on group performance and group member perceptions (Figure 1). It builds on the work of Mennecke and Bradley (1997) which sought to examine the impact of role assignment on team performance and attitudes. To extend this research, we manipulated not only role assignment but also training in group processes. There were three levels of intervention. The baseline level was identical to that described by Mennecke and Bradley (1997); that is, baseline groups were exposed to neither training nor to role assignment. The level 2 intervention consisted of role assignment. The roles were identical to those used by Mennecke and Bradley (1997); that is, group members were assigned roles that were relevant to structuring their group interactions (Figure 2). The level 3 intervention consisted of both role assignment and training. In this treatment group members were not only assigned the roles used in the level 2 treatment, but they were also presented with six training sessions that dealt with a variety of topics related to planning meetings, promoting effective group processes, and resolving conflict (see Figure 3).

Several dependent variables were examined in the study (Figure 1). These variables can broadly be classified as either performance measures or perceptual measures. The primary performance measure is the students' project grades. The perceptual measures include group cohesion, member satisfaction with their interactions in the group, member ratings of leadership in the group, and member satisfaction with their group's performance. The *Attraction to Group* instrument designed by Evans and Jarvis (1986) was used to capture individual perceptions of group cohesion. The participation and satisfaction scales were adapted from Green and Taber's (1980) instrument. Several covariates were also examined. These include student demographic data, student GPA, and other information about the course. All perceptual measures and ratings were captured using questionnaires.

FIGURE 1
INDEPENDENT AND DEPENDENT VARIABLES

	Variable	Source
Treatment Levels		
Level 1	Baseline	No intervention
Level 2	Role Assignments	Group members assigned roles by instructor
Level 3	Training and Role Assignments	Group members assigned roles by instructor AND Group members presented with six training sessions that dealt with a variety of topics related to group processes
Dependent Variables	Group Cohesion	Questionnaire (beginning, middle, and end of semester)
	Group Member Satisfaction	Questionnaire (end of semester)
	Perceived Negative Social Behaviors	Questionnaire (end of semester)
	Project Grade	Assigned by Instructor
Covariates	Demographic Data (age, gender, experience with db software, etc.)	Questionnaire (beginning of semester)
	Student GPA	Questionnaire
	Instructor	Assigned

FIGURE 2
STUDENT ROLES

Role	Description of Responsibilities
Presider or Meeting Leader:	This person is responsible for keeping the group's meetings on task. This person should develop an agenda for the meeting and let other group members know the agenda. This person should monitor the group's progress during each meeting and identify where deviations from the agenda occur.
File Manager or Project Master	This person is responsible for making sure that the assignment/project files are secure, that backup copies are frequently made, and that all members have current copies of all assignments. Where necessary, this person is to coordinate the integration of different components of the database project. This person is to maintain frequent contact with other group members to make sure that they have current copies of all files.
Meeting Coordinator	This person is responsible for knowing the schedules for everyone on the team (a schedule should be turned in to this member immediately), deciding (based on these schedules) about the dates and times of team meetings, and notifying members of the scheduled meetings. This person has the authority to call a meeting as long as no conflicts exist with any member's *official* schedule.
Intermediary	This person is responsible for acting as the primary intermediary between the group and the course instructor. This person is to meet periodically with the instructor to discuss the progress of the group (this does not preclude other members from meeting with the instructor). This person should be aware of how the team is progressing on the project and whether there are any major conflicts between any members.

FIGURE 3
TRAINING SESSIONS FOR TREATMENT SECTIONS[1]

Training Session 1

Goals for the First Few Meetings

Topics:
- A. Build relationships between team members
- B. Understand the roles that team members will play in the group meetings
- C. Identify the project goals for the team

Training Session 2

Stages of Group Development

Topics:
- A. Forming
- B. Storming
- C. Norming
- D. Performing

Training Session 3

Quality Leadership

Topics:
- A. Leaders focus on quality
- B. Leaders structure work
- C. Leaders facilitate discussion
- D. Leaders encourage cooperation and participation
- E. Look for opportunities to learn and improve

Training Session 4

Issues in Decision Making

Topics:
- A. Symptoms of Groupthink and faulty group behavior
- B. Techniques to use to overcome faulty group behavior
  1. Brainstorming
  2. Multivoting
  3. Nominal Group Technique

FIGURE 3
(continued)

Training Session 5 Managing Conflict
Topics:
- A. Competitive conflict
- B. Cooperative conflict
- C. Techniques for developing cooperative conflict

Training Session 6 Quality Improvement
Topics:
- A. Techniques to improve quality
- B. Product improvements to improve quality

[1] The content for these training sessions was adapted from Scholtes, 1992

Subjects

Participants were recruited from eight sections of a core business course in information systems (DSCI 3063) taught at East Carolina University. In all cases treatment conditions were randomly assigned to course sections, therefore students did not have a choice about which treatment section they were in. However, all students were told that a research study was being conducted and that they were not required to participate in data collection nor to turn in questionnaires.

Experimental Procedures

The data reported in this paper was collected during two different semesters, spring 1997 and spring 1998. Three instructors (the three authors) taught the 8 sections of the course involved in the research with two of the authors teaching two sections of the course and one of the authors teaching four sections (see Figure 4). Data for the baseline condition and half of the data for the role assignment treatment were collected during the spring of 1997. Additional data for the role assignment treatment and all of the data for the training treatment were collected during the spring of 1998. Treatments were randomly assigned to the instructor and the sections.

FIGURE 4
SEQUENCE OF DATA COLLECTION AND COURSE INSTRUCTORS

	Instructor 1	Instructor 2	Instructor 3
Spring 1997	1 Level 1 Treatment Section 1 Level 2 Treatment Section	1 Level 1 Treatment Section 1 Level 2 Treatment Section	
Spring 1998		1 Level 2 Treatment Sections 1 Level 3 Treatment Section	2 Level 2 Treatment Sections 2 Level 3 Treatment Section

In the sections receiving the level 3 treatment, the training was presented to students in six separate class sessions. These training sessions were presented to students approximately every other week during the last two-thirds of the semester. In the sections receiving role assignments (both the level 2 and level 3 treatments) the roles were presented to the student groups during one of the class sessions. During this session, the roles were explained and students were asked to assume one of the roles during their work on the project. Students in each group were allowed to select which role they wanted to assume. Periodically during the semester students in these sections were reminded about the roles. Further, during the middle part of the semester, groups in all sections of the course were required to meet with the instructor to discuss their group, the course project, and to ask questions. Students that had been assigned roles were individually reminded of their roles during this meeting and encouraged to continue to engage in their role during the remainder of the semester.

Data was collected several times during the semester. For example, a demographic questionnaire was administered before groups were assigned and the course project introduced. This instrument asked for information such as the students' GPA, gender, experience using database software, and related information. Shortly after this, students were assigned to groups and roles were introduced to groups receiving this intervention. Approximately one week after groups were assigned, the group cohesion questionnaire was administered for the first time. Training was initiated approximately two weeks after groups were first formed and continued to be presented to students once every two weeks through the remainder of the semester. The cohesion questionnaire was administered again during the middle of the semester and also during the last week of the semester. In addition, students were asked to complete a questionnaire at the end of the semester that allowed them to evaluate the course, the instructor, and their group, plus this questionnaire allowed them to express their satisfaction with their project and their performance in the group.

The Course Project

The course is a common body course that is required for all business majors (School of Business majors include Accounting, Marketing, Finance, Management, Decision Sciences). One half of the course content is the development of an information system using Microsoft Access. The projects used in all sections of the course were selected by the researchers and involved fairly complex programming techniques. Although the projects used during the spring of 1997 and spring of 1998 differed in small ways (e.g., the "client" for the spring 1997 semester project was a campus group while the client for the spring 1998 semester project was a university administrator), the project requirements and level of difficulty were similar. Important components of the project were demonstrated to students in class sessions, but the students were responsible for applying these techniques in the development of their own information system. For most of the students, this resulted in a significant dependence on the other team members. Because of the scope and difficulty of the project, teams had to work well together to complete the project successfully.

RESULTS

The primary variables of interest in this study are student performance on their group's project, perceptions about cohesion, perceptions about satisfaction, and perceptions about their group. The means for the dependent variables are summarized in Table 1. The results of the analyses related to each of the variables are discussed below.

Control Variables

We examined a number of control variables to verify that extraneous factors such as the semester during which data were collected, the gender of the responder, the GPA of the responder, and the instructor did not have an impact on the results. The results indicate that there were no significant differences on age, gender, GPA, and database experience between the population of students during the spring 1997 and spring 1998 semesters and, for that matter, between any of the treatment conditions. Further, we examined the students' rating of their instructor's teaching quality as well as which instructor taught their section of the course. Neither of these variables were found to be significantly different across any of the treatment conditions nor significantly related to any of the dependent measures. Thus, we conclude that the population of students in each treatment and the quality of instruction in each section did not confound the results.

Cohesion

Our expectation was that group members in the role assignment treatment condition would develop more favorable perceptions of their group when compared to individuals in the baseline condition. In addition, we expected that group members in the training treatment condition would develop more favorable perceptions than all other groups. Cohesion was measured three times during the semester in order to examine the impact of the treatments on group member feelings about their group over time. The cohesion instrument was first delivered approximately one week after groups were formed (Time Period 1).

The instrument was again delivered during the seventh week after groups were formed (Time Period 2). The third data collection occurred on either the last class meeting before the group projects were due or on the project due date -- approximately eleven weeks after groups were first formed (Time Period 3). The reliability scores for the cohesion scale are shown in Table 1.

To identify whether groups had similar perceptions about cohesion when they were first formed, we performed an ANOVA comparing cohesion scores across the treatment conditions for the first time period. The results show that, although marginal, groups did not have significantly different perceptions of cohesion shortly after they were formed (F{1,194}=2.453; p=0.089). Further, an analysis comparing respondents to the cohesion scale to non-respondents indicates that there is no significant difference between these groups in terms of age, gender, GPA, or experience with database software.

Because cohesion was captured repeatedly during the semester, this variable was examined using a repeated-measures multivariate analysis of variance (MANOVA). A repeated-measures MANOVA accounts for the dependence between the multiple observations of the dependent variable(s). Because a repeated measures MANOVA examines a variable over successive observations, responses were only used if an observation existed for all three of the time periods. The results of the MANOVA show that over time group members in both the treatment conditions reported significantly higher cohesion than did members of the control group (F{2,143}=7.532; p=0.001). A post hoc paired comparisons analysis (using LSD) demonstrates that at the second time period both the level 2 (role assignment alone; p=0.001) and level 3 (training plus role assignment; p<0.001) treatments had significantly higher cohesion than did the baseline groups. Further, the post hoc analysis also demonstrates that at the third time period groups in the level 3 treatment (training plus role assignment) not only had significantly higher cohesion than the baseline groups (p=0.001) but they also had marginally higher cohesion than did the groups in the level 2 treatment (p=0.076).

TABLE 1
MEANS AND STANDARD DEVIATION SCORES FOR DEPENDENT MEASURES

	Treatment Conditions		
	Level 1:	**Level 2**	**Level 3**
Dependent measures	Baseline	Role Assignment	Training and Role Assignment
Standardized Project Scores	n=46	n=112	n=60
Mean	84.7	88.1	90.1
Std Dev.	9.6	8.1	5.0
Cohesion[1] (larger = greater cohesion)	n=25	n=85	n=25
Time Period 1			
Mean	150.7	159.5	158.4
Std Dev.	18.5	18.1	15.0
Time Period 2			
Mean	143.0	156.5	159.7
Std Dev.	24.0	16.1	13.7
Time Period 3			
Mean	135.2	149.1	158.7
Std Dev.	31.6	29.3	16.9
Satisfaction with the Group's Process[2] (larger = lower satisfaction)	n=32	n=99	n=59
Mean	10.4	9.1	10.1
Std Dev.	5.2	4.6	4.5
Satisfaction with the Group's Project[3] (larger = higher satisfaction)	n=35	n=103	n=59
Mean	7.8	8.5	8.5
Std Dev.	1.6	1.8	1.8

TABLE 1
(continued)

Existence of Negative Social Behaviors[4] (larger = greater negative behavior)	n=36	n=103	n=59
Mean	5.8	4.8	5.1
Std Dev.	2.7	2.1	2.1

[1] The cohesion scale is composed of 20, 9-point items. Reliability: a=0.984

[2] The process satisfaction scale is composed of 5, 5-point items. Reliability: a=0.921

[3] The project satisfaction scale is composed of 2, 5-point items. Reliability: a=0.730

[4] The social behavior scale is composed of 4, 5-point items. Reliability: a=0.667

Further, the trend of the results show that cohesion in the level 1 and level 2 groups fell over time, but cohesion remained constant in the level 3 treatment condition (see Figure 5). Thus, both the role assignment and training appear to have had a positive impact on group member cohesion, but training plus role assignment provides marginally superior results.

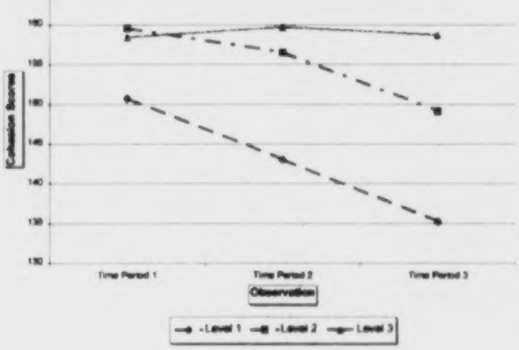
Other Perceptual Measures

Satisfaction with the group's meeting process, satisfaction with the group's project, and group member ratings of negative social behavior were all measured. Neither of the satisfaction measures were found to be significantly different across the treatment conditions. However, the results for expressed negative social behavior show that there is a marginally significant difference across the treatment conditions (F{2,197}=2.930; p=0.056). A post hoc paired comparison analysis (using LSD) demonstrates that groups in treatment level 2 (role assignment) exhibited significantly less negative social behavior than the groups in the baseline treatment (p=0.017). None of the other treatment levels showed a significant difference.

Performance

To examine the project scores, the scores within each section of the course were standardized to facilitate comparisons between different instructors and sections. For example, one instructor provided extra credit on the project while the other instructors did not. The results for the standardized project grades show that the groups in the two treatment conditions scored significantly higher on their projects than did groups in the control condition (F{2,217}=6.360, p.=0.002). These results indicate that the treatments had a significant positive impact on group performance. A post hoc analysis (using LSD) demonstrates that groups in treatment level 2 (role assignment) had significantly high project grades than the groups in the baseline condition (p=0.014). Furthermore, project scores for groups in the level 3 treatment were marginally higher than those for groups in the level 2 treatment (p=0.104).

FIGURE 5
TRENDS IN COHESION DATA FOR TREATMENTS AND TIME PERIODS



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DISCUSSION

Many researchers have observed that groups change considerably as they develop over even short time periods (Carley, 1986; Hollingshead, McGrath, & O'Conner, 1993; McGrath, 1990). For example, the literature on group development indicates that interacting groups progress through various phases as they develop (Hollingshead et al., 1993; Mennecke, Hoffer, & Wynne, 1992; Poole, 1983; Poole & Doelger, 1986; Poole & Roth, 1989). Therefore, during the course of a typical semester, the dynamics within a team are likely to change considerably. During the early portion of the semester, the teams' tasks are comparatively simple and students will likely feel little stress associated with their group experiences. However, as the semester progresses, pressures associated with completing their project intensify at the same time that competition from other courses for a student's time and energies increases. As the due date for the project draws near, pressure increases and intra-group cohesion decreases as disagreements and conflicts arise related to completing the project. In addition to these problems, groups frequently have one or more members who are not as strongly motivated and curtail their participation in the group's activities (i.e., they free load).

This scenario is probably not uncommon for many student project teams. In one sense, this is a natural part of group life since conflict within groups is inevitable, particularly as external pressures increase. But does it have to be this way? Is there anything that can be done to help student project teams perform and interact more effectively? These are the questions we set out to answer in this research. Our expectation was that students who were knowledgeable about problems that groups typically face as well as techniques for addressing these problems would be better equipped to deal with these issues. Our results suggest that training project teams about group process does help them to outperform groups that did not receive this training. For example, while cohesion was lower at the end of the semester than at the beginning for the baseline groups and the groups that were assigned roles, the cohesion remained relatively constant for groups that also received training. Similarly, groups receiving training also had marginally higher project scores than did groups in the other treatments. Thus, training in group processes appears to have had a positive impact on group members' feelings about their group and their performance on their project.

The level 2 treatment, role assignments, also appears to have had an important positive impact on students' perceptions and performance. The roles that were assigned to the treatment groups were designed to help group members accomplish several core group functions. Often people working in groups have an innate awareness of the need to complete many of the functions represented by these roles. It is often very difficult, however, for individuals to take the lead by performing the functions represented by the roles. Furthermore, if only one or two group members perform these functions then they alone are burdened with the work required to complete these chores. If, on the other hand, roles are assigned to group members, then the work involved in completing the functions represented in each role is disseminated among the group members. Further, role assignment by the course instructor also sets expectations about appropriate behaviors and individual members are given authority to take action under the auspices of their role. In this way, many of the burdens that emergent leaders face are reduced.

Group performance, as measured by project scores, was also positively impacted by the treatments. Groups in the level 2 treatment had higher project grades than students in the baseline and groups in the level 3 treatment had higher project scores than all other groups. It is not clear from our results whether there is a direct cause and effect relationship between cohesion and performance or whether these variables might have a deeper relationship. However, prior research has shown that cohesion and performance are often related (Dorfman & Stephen, 1984; Evans & Dion, 1991; Greene, 1989; Keller, 1986; Wech et al. 1998). For example, Greene (1989) showed that cohesion and productivity had a reciprocal relationship; as productivity rose, cohesion also increased, which, in turn, would improve productivity. However, some evidence exists that in ongoing groups, cohesion has an antecedent relationship to performance and can be used to predict it. Apparently some groups that develop greater cohesion work better together and therefore produce better output (Dorfman & Stephen, 1984; Keller, 1986).

Why do these interventions help student teams? One explanation is that training on group processes and the assignment of roles can be seen to be specific interventions that provide groups with guidance on how to more effectively accomplish their projects. Therefore, the instructors provided students not only with information about group processes and the important roles and functions that needed to be incorporated into their groups, but also with a cue that helped these groups transition to a more effective work routine. For example, Gersick (1988, 1989) points out that it is difficult for groups to transition to new modes of work and to new group structures without external cues. Furthermore, Gersick and Hackman (1990) indicate that this transition will not happen until the time is right for a change and there is a specific impetus to change. The impetus may include events such as a significant failure, reaching a milestone in the group's life cycle (e.g., "We only have one week left to complete this project!"), or the receipt of an external intervention (e.g., the instructor meeting with student teams to encourage them to work together or to resolve problems). In this case it appears that training and role assignment helped groups to more effectively transition to new, more effective work routines.

Since these interventions were not provided to groups in the control condition, these groups had to deal not only with the task-related issues (i.e., building their information system), but also with interpersonal issues related to managing conflict, deciding how to make decisions, identifying symptoms of faulty behavior, and identifying the role that each group member would assume in the group. This is in line with McGrath's Time, Interaction, and Process (TIP) Theory. McGrath (1991) suggests that groups develop differently depending on the difficulty of the task and problem solving context. TIP theory proposes that groups typically engage in three simultaneous functions: a member support function, a group well-being function, and a production function. Therefore, when group members process a task, they do more than just work on the task, they weave into the task those behaviors that are designed to support members and foster the well being of the group. He suggests that groups facing a simple problem or one that they are familiar with will be able to move directly from early stages of their group's development to stages where they can focus on task completion. On the other hand, groups that encounter a highly complex task or a task that they are unfamiliar with will need to engage in a number of social and interpersonal behaviors required to make the group functional. From this perspective it can be seen that the interventions we provided to our student teams helped them to better deal with the member support and group well-being functions. In this context, it is no wonder that cohesion within the baseline groups would be significantly lower at the close of the semester when compared to the two treatment groups.

The assignment of roles and responsibilities in a group is one of the factors regularly found in business environments. If I attend a faculty meeting, for example, I generally know what my role is and what I need to do to help the group function well during the meeting. Yet, in many courses the common practice of most instructors is to put groups together and then turn them loose to perform their assigned tasks. Our results suggest that instructors should do more to provide guidance for their groups. They should clarify the tasks that are critical to the functioning of the group, alert students to potential problems their groups may encounter, show them how to resolve conflict, tell them about group processes, and define roles for students.

FUTURE RESEARCH

The results of this study indicate that interventions into student project teams have a demonstrably favorable impact on performance and perceptions. These results also suggest several possibilities for future research into this and related pedagogical issues. For example, this research was carried out in a course involving a semester-long project that was very demanding and time consuming. A question that has yet to be resolved concerns whether this type of intervention will be needed for shorter term and/or less intense projects. For example, less intense projects would likely not carry transaction costs that are as high. In these instances, groups may be able evolve adequate group structures themselves without external interventions.

In addition, future research should investigate other interventions that might help groups function more effectively. For example, collaborative technologies such as group support systems, chat rooms, email, and similar groupware tools should help groups to better coordinate their activities. One of the problems students encounter when working in teams is the diversity and conflict present in the group members' schedules. Collaborative tools should allow team members to conduct virtual meetings and thereby overcome some of these scheduling conflicts.

LIMITATIONS

Generalizations of the findings from this research are limited by the methodologies used to construct the experimental manipulations and collect the data. For example, the three instructors teaching the eight sections of the course were knowledgeable about the nature of the research and the expected results. To control for this, every attempt was made to standardize the construction and delivery of the manipulations and the course content. For example, the instructors coordinated the content and delivery of syllabi, texts, assignments, exams, and instructions. The fact that the instructor teaching the student's class was not found to be a significant covariant supports the view that these precautions helped to control for the differences in instruction. Nevertheless, the variations that existed in each class because of the differences in teaching philosophies and techniques applied by each instructor should be considered in interpreting these results.

Finally, it should be recognized that the respondents to the questionnaires represent only a sample of the students that were enrolled in the course. We could not force students to complete questionnaires, therefore many elected to withhold their responses. It is possible that respondents are not representative of the class as a whole. Nevertheless, an analysis of the demographic data comparing respondents to the cohesion questionnaire to non-respondents showed that they were not significantly different in terms of age, GPA, and other vital data. Therefore, our findings are likely representative of the population of students in the course and of most business students.

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A LAB-ORIENTED APPROACH TO TEAMWORK PROJECTS IN COMPUTER INFORMATION SYSTEMS COURSES

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Teamwork in a real life project is an integral part of many upper level computer information systems courses including systems analysis and design, software engineering, database systems etc. Major difficulties for the instructor in a project oriented course, however, are the selection of appropriate projects, determination of the team compositions, and implementation guidelines. Most research efforts in the area of team projects concentrate on the selection of appropriate projects and determination of team compositions. However, all these approaches ignore the important issue of institutional settings with different type of students, e.g., traditional, non-traditional, full-time, part-time, and commuter. This paper reports our approach of teamwork projects in a systems analysis course. In this approach we use class time as lab to allow for students team meetings and other systems analysis tasks. This approach is specially appropriate for non-traditional and commuter students. Details of our approach, its success, and its drawback are presented.

INTRODUCTION

Teamwork in a real life project is an integral part of many upper-level computer information systems courses including systems analysis and design, software engineering, database systems etc. Major difficulties for the instructor in a project oriented course, however, are the selection of appropriate projects, determination of the team compositions, and implementation guidelines. Most research efforts in the area of team projects concentrate on the selection of appropriate projects and determination of team compositions [2, 3, 4, 6, 8]. Some researchers suggest assigning one project to the entire class such as part of a campus-based registration system [1]. Others require that students identify and work on an industry-related project [5]. However, all these approaches ignore the important issue of institutional settings with different type of students, e.g., traditional, non-traditional, full-time, part-time, and commuter. While team projects may be effective with traditional students at average to large-size schools, they may not be suitable for use at small schools with non-traditional and commuter students.

The amount of time that non-traditional and commuter students allocate to the teamwork project outside the classroom is often limited. To overcome this problem, a new approach to teamwork in real-life projects has been employed which seems to work very well. In this lab-oriented approach the three components of teamwork in real-life projects are handled in the following manner. The first component, team organization, allows students to select their team members. However, students are reminded that this is not the way that teams are selected in the industry. Again, because most of our students are non-traditional the approach of instructor forming the teams did not work previously at our department, at least for the instructor. For the second component, project identification, students are asked to identify possible projects from their place of employment in which they could play the role of the client. Since the majority of our students are employed in a computer-related company, this task can be accomplished with little difficulty. Once projects are identified, the instructor selects some of the most appropriate projects and assigns projects to teams of 3 to 4 students. To address the third component, implementation guidelines, the class time is divided into two parts, lecture and lab. The lab part is designed to facilitate teamwork issues such as interviews, discussions, and team meetings. Individual students do their individual project assignment outside the lab. Each team plays the dual role of analyst and client. The client team is responsible for providing sufficient information about the project to the analyst team during the interview process. Upon delivery of each phase, the client team is also responsible for verification and confirmation of the project deliverables. In addition, the client team should also grade the delivered phase. The analyst team is responsible for preparing requirement specifications, design, entity relationship diagram, data flow diagram, and data dictionary documents. In this approach there would be no conflict on team meeting times.

A similar approach has been reported in [9]. However, the approach that has been taken in this work is different in many respects. In our client-systems analysis, partners are a team of students not just a single student. Assigned projects in our case are real life projects that have been identified by students as opposed to hypothetical projects. In addition, our focus is on the design and analysis of software systems not implementation using Access. Moreover, each phase of the project has its own specification and criteria for grading.

PROJECT IDENTIFICATION

The majority of computer science majors at our institution are working professionals who hold full-time positions, commuting approximately 30-50 miles per day to school, and have family commitments. During the first two weeks of the quarter (10 weeks session) the students are asked to identify a project from their place of employment, write a one-page specification, and submit it to the instructor for approval. The instructor reviews the project specifications. Some of the specifications may have to be redone; others may have to be rejected. Once the projects have been identified, the instructor assigns projects to students in such a way that each team is knowledgeable about the project so that they can play the client role for another team. If there is a student within a team that is not familiar with project, (s)he must learn about the project. The project deliverables should be done phase by phase as is shown in Table 1. This way the task of verification of project correctness and grading would be handled more efficiently. Some of the projects that were chosen in the Winter quarter 1998 include, billing and accounting systems of small firms, automated access to resident hall of our campus, and merchandise return system of a department store.

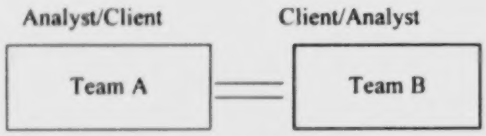
THE LAB COMPONENT

The systems analysis course at our institution is a five credit hour course at the 300 level. The course meets 5 times a week in which 3 hours are spent in formal lecture and 2 hours in the project. The intention is to have a lab-oriented approach similar to a programming course. During the lab hours students work on different phases of their project, e.g., interviews, requirement analysis, team meetings, project delivery, trouble shooting, etc. When this approach was taken, in the Winter Quarter of 1998, the students were divided into teams of 3 members each. The team structure was optional, meaning that students selected their team members. The teams were partitioned into two groups where one group served as the client and the other group served as the systems analyst. For example, team A interviewed team B and team B interviewed teams A and so forth (see Figure 1).

TABLE 1
PROJECT PHASES

Schedule	Topic
Week 1	Team Composition
Week 2.	Project Proposal
Week 3	Project Approval & Schedule
Week 4 & 5	Current System Description
Week 6	DFD, DD, & ER-Diagram
Week 7	User Requirement Document
Week 8 & 9	System, I/O, Form, & ERD Design
Week 10	Project Presentation

FIGURE 1
CLIENT/ANALYST RELATION



In this way all teams are able to assume the roles of both client and systems analyst. All interviewing activity took place during the lab session, thereby, avoiding team meetings conflicts. Students divided their work among team members and each worked individually outside the classroom on his/her portion of the project. Once they completed a phase of the project they have to submit the phase to the client team and to the instructor for grading. Clients are also responsible for grading the submitted phase based on pre-determined criteria [7](see Table 2). The team's grade and the instructor's grade are averaged to determine the final grade for the given phase. This process is carried out for each phase of the project as listed in Table 1.

TABLE 2
SAMPLE OF CRITERIA FOR GRADING

Criteria	Points
Grammar/Punctuation, etc.	10
Professional Appearance	10
Executive Summary	5
Physical DFDs	20
Narrative Description	15
Processing Volumes	10
Entity Relationship Diagram	10
Problem Statement	15
Overall Impression	5

STUDENT'S EVALUATION AND CONCLUSION

As is generally the case in the real world, deadline violations, scheduling conflicts, lack of cooperation of team members, and unpredictable circumstances cause delays and this course was no exception. In all these cases adjustments were made to accommodate changes. The lab part was the most exciting part of the course. Students rarely missed the lab and had ample time to discuss project issues during the lab. Our approach worked much better than traditional teamwork where students have difficulty finding a mutually convenient meeting time. Another advantage of a lab-oriented approach is that students have access to their clients during the entire quarter. This is not the case when clients are chosen from industry or from a campus business. Overall this new lab-oriented approach meets several important objectives. First, the students gain experience of teamwork in real-life projects. The team meeting conflict is completely avoided. Students are highly motivated to work on their projects. They are eager to work in groups during the lab time on different aspects of their projects. Table 3 summarizes students' responses to the questionnaire that was distributed at the end of the quarter.

TABLE 3
STUDENTS' EVALUATION

Question	% Excellent	% Very Good	% Good	% OK	% Poor
How would you rate your project team size?	47	23	18	6	6
How would you rate your project size?	12	42	20	24	2
How would you rate your project Complexity?	12	30	24	30	4
How would you rate your project type?	18	53	18	7	4
How would you rate the teamwork?	30	41	12	12	5
How would you rate gaining real Life experience?	18	41	30	6	5
How would you rate gaining Skills difficult to learn in class?	28	35	18	6	13
How would you rate gaining confidence in professional skills?	23	35	24	18	0
How would you rate learning Application of course concepts?	30	41	18	18	3
How would you rate gaining Technical communication skills?	12	35	24	24	5

These results illustrates that our approach not only helped students to learn course material but also helped them to learn and improve their systems analysis skills such as communication, people's relation, interview, critical thinking and so forth.

One of the drawbacks of this approach as opposed to traditional teamwork is the identification of many projects of similar complexity. For traditional students this would be hard. In our case since the majority of our students are non-traditional this task was performed with little or no difficulty. Other problems encountered in our first experience of applying this technique are the followings: On one team, students blamed each other for lack of cooperation. Peer evaluation was brought to their attention, but still some students were reluctant to do another student's job. On another occasion, one team was unhappy with their project, but it was too late to change the project.

Overall, students were extremely satisfied with this lab-oriented approach. When asked to propose another possible project for the course, one student replied, "I don't know of any better way we could do for a project. This was very good". Another student when asked to propose another team structure for the course responded with, "I think this team structure is the best-not too large not too small". Based on the results from this new lab-oriented team project approach, plans are underway to continue experimenting with using different types of projects in a variety of courses.

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MANAGING INFORMATION TECHNOLOGY FOR PERFORMANCE: INFORMATION SYSTEMS EDUCATION FOR EXECUTIVES

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The support of top managers is advocated by both researchers and information professionals as a crucial element for the successful deployment of information technology in organizations. Executive education programs are an important source of information systems knowledge for top managers, and hold the potential to influence the level of executive involvement in information systems management. This article offers a theory-based course development methodology for the creation of an IS course to address the needs of top executives. A survey of institutions offering the Executive MBA degree reveals that an alarming proportion of executive management programs fail to provide course coverage of important information systems management topics. The content and delivery of the information systems component of the Executive MBA program can be substantially enhanced through the use of a course development methodology grounded in relevant information systems research and theories of adult, individual, and organizational learning. A model course created with a theory-based development methodology was implemented and evaluated by Executive MBA students. The results show that the information systems course in Executive MBA programs can be both relevant and valuable for executives when careful attention is paid to the development of course content and process.

INTRODUCTION

Top management support has been emphasized by both researchers and information systems (IS) professionals as a key element for achieving greater benefits from information technology (IT) and positive returns on IS investments (Jarvenpaa and Ives, 1991). The level of senior executive involvement and participation in the management of IT is likely to be influenced by the attitudes and belief system the executive has with respect to the IS function within the organization. In turn, the executive's belief system is determined in part by personal dimensions, such as age, functional experience, and educational background (Song, 1982). The IS education provided to executives has the potential to influence their involvement in the IT management process, and thus impact the contribution of IS to organizational performance.

Executive MBA programs provide one potential source of IS education and training for top management. The objectives of this paper are to examine the IS component of current Executive MBA curricula and describe the development of a model course which meets the IS educational needs of executives. In the following section, the dimensions of the IS course in executive education are examined. Next, the results of a study of the IS component in current Executive MBA programs are presented and discussed. A description of the development and implementation of a model IS course is then provided. The paper concludes with recommendations for on going IS course development and commentary on the future of the IS component in Executive MBA education.

DIMENSIONS OF INFORMATION SYSTEMS EDUCATION

The IS component of Executive MBA programs can be described along two key dimensions: content and process. Content refers to the subject matter and topic areas covered in the IS course. Process refers to the means by which IS knowledge is transmitted to, or acquired by, learners participating in the IS course. These two dimensions are discussed below in further detail.

Course Content

IS course content typically addresses both *information technology* and *information systems* topics. In this context, *information technology* refers to the hardware and software elements of data processing, office automation, telecommunications, and other electronic technologies (Derived from Martin, DeHayes, Hoffer and Perkins, 1991). *Information systems* refer to the collection of computer programs, hardware, people, procedures, documentation, forms, inputs, and outputs used to support an organization. An information system consists of these elements and their interrelationships (Derived from Shore, 1988). Based on these definitions for IT and IS, IT is a subset of IS. As such, IT focuses on the technological components of IS. Examples of topics within the IT content area include fundamental concepts of computer hardware and software, personal computing skills, and advanced information technologies. Advanced information technology refers to emerging technologies and technological trends which industry and academic leaders have identified as key innovative elements for business. Specific advanced information technologies may include collaborative systems, multimedia, or internet applications.

On a broader level, IS topics examine the interplay between IT and organizational environments. Examples of topics within the IS content area include the management of the information resource, making effective use of the data resource, and the strategic alignment of the IS function with the organization.

Several studies have examined the content of executive management programs from the perspective of current students, alumni, deans, faculty, and corporate representatives (Weber, 1994; Kassner and Fertig, 1992; Porter and McKibbin, 1988;). Porter and McKibbin (1988) examined management education and development trends in a study initiated by the American Assembly of Collegiate Schools of Business (AACSB). In the study Deans and faculty expressed the need to give computer skills more coverage in the management education curriculum. However, corporate respondents rated computer skills fairly low, compared with such skills as analytical thinking, leadership, and oral communication skills.

A study of alumni of a large midwestern university identified information technology as a growing area of interest. Kassner and Fertig (1992) asked the alumni of an executive MBA program to describe their experience in terms of *what the content was* and *what the content should have been.* Advanced information technology was ranked fourth in terms of topics which "should have been covered," after the more traditional topics such as general management skills, development and formulation of business strategies, and financial management. Thus, alumni appeared to think that advanced information technology, along with more traditional topics, should be allocated the greater amount of time in the curriculum.

The trend toward more coverage of advanced information technologies is driven by the emergence and proliferation of a variety of computer-based decision support systems, including expert systems and executive information systems. In addition, new information systems and technologies, such as groupware and electronic data interchange, possess innovative and strategic capabilities. In the future, effective executives must be able to interpret technological trends and assess the potential impacts of new IT on the organization. The findings of the Kassner and Fertig study (1992) are compatible with the outcome of a series of focus group sessions conducted during the revision of an Executive MBA program at another midwestern university. Both current students and alumni indicated a need for more coverage of advanced information technology (Weber, 1994).

IS researchers provide an additional perspective on the appropriate content of IS education for executives (Kunde, 1989; Lane, 1985; O'Toole and O'Toole, 1966). They suggest that while it is not necessary for top managers to be experts on the "how-to" of information technology, they should be familiar with what information technology can do for the organization, knowledgeable about the organization's IS activities, and well-informed about IS competitive capabilities and initiatives.

The content dimension of an IS course for executives is of particular importance in light of recent allegations that university-sponsored management education programs are failing to keep pace with modern business realities (Sheridan, 1993). The result has been a gap between the competencies provided by university education and the knowledge required managing organizations in an increasingly complex business environment. Unfortunately, the suggestions found in the previously discussed studies provide too narrow and limited a perspective on the IS educational needs of top executives to produce viable course content guidelines.

An alternative approach to developing IS course content for the Executive MBA curriculum is based on an examination of current and emerging issues in the management of IS, and the relationship between IT, IS, and organizations. Several studies in these areas provide guidance and justification for IS course content. A study recently reported by the University of Minnesota Management Information Research Center identified the key management issues on which executives will focus time and resource investment during the mid-1990s (Janz, Brancheau, and Wetherbe, 1995). The top 20 issues identified by the study are shown in Column A of Table 1.

While the key issues were derived from rankings provided by chief information officers and other senior IS executives, the topics they represent are highly relevant to the IS educational needs of Executive MBA program participants for several reasons. First, senior IS executives are typically at a level that places them on a peer basis with other executive managers. Frequently, the senior IS executive fills a dual role as chief financial officer or chief operations officer within the organization. Therefore the IS management issues defined by a group of senior IS executives are likely to be highly congruent with

TABLE 1
KEY ISSUES IN IS MANAGEMENT AND EDUCATION

Top 20 IS Management Issues (Janz, Brancheau, Wetherbe, 1995)	**Top 20 IS Topics Covered in Current EMBA Programs (No. of Courses)**
1. Developing an Information Architecture.	1. Computer Hardware/Software Fundamentals (94)
2. Making Effective Use of the Data Resource	2. Personal Computing Skills (73)
3. Improving IS Strategic Planning	3. Overview of Computing/IS in Organizations (62)
4. Specifying, Recruiting, and Developing IS Human Resources	4. Increasing Understanding of Role and Contribution of IS (56)
5. Facilitating Organizational Learning and Use of IS Technologies	5. Facilitating and Managing Decision and Executive Support Systems (55)
6. Building a Responsive IT Infrastructure	6. Systems Development Life Cycle (52)
7. Aligning the IS Organization with that of the Enterprise	7. Management Information Systems(35)
8. Using Information Systems for Competitive Advantage	8. Making Effective Use of the Data Resource(24)
9. Improving the Quality of Software Development	9. Improving IS Strategic Planning (24)
10. Planning and Implementing a Telecommunications System	10. Planning and Implementing a Telecommunications System (16)
11. Increasing Understanding of Role and Contribution of IS	11. Planning and Using CASE Technology (14)
12. Enabling Multi-Vendor Data Interchange and Integration	12. Aligning the IS Organization with that of the Enterprise (13)
13. Developing and Managing Distributed Systems	13. Developing and Managing Distributed Systems (13)
14. Planning and Using CASE Technology	14. Facilitating Organizational Learning and Use of IS Technologies (12)
15. Planning and Managing the Applications Portfolio	15. Improving the Quality of Software Development (11)
16. Measuring IS Effectiveness and Productivity	16. Advanced Information Technology Uses and Capabilities (10)
17. Facilitating and Managing Decision and Executive Support Systems	17. Using Information Systems for Competitive Advantage (9)
18. Facilitating and Managing End-User Computing	18. Developing an Information Architecture (6)
19. Improving Information and Security Control	19. Building a Responsive IT Infrastructure (6)
20. Establishing Effective Disaster Recovery Capabilities	20. Enabling Multi-Vendor Data Interchange and Integration(6)

the views of other executive managers. In addition, IS issues and IT investment opportunities brought before executive management teams by senior IS executives will undoubtedly relate to the key issues identified by the study. Second, a study of Fortune 500 senior executives revealed that chief executive officers, chief financial officers, and chief operations officers in 95% of the companies surveyed agree that information technology plays a central role in the success of their company (Nolan, Norton & Company, 1994). Due to the importance given information technology, 75% of these executives either direct or review the IT investments of their organizations. Thus it is not surprising that respondents also indicated considerable interest in executive education and IT management training to help them better understand how to fully leverage information technology's potential. Since the senior IS executive is the key source of IT knowledge for most senior executives (Newsbytes, 1994), it is reasonable to assume congruence between key IS issues of senior IS executives and those of other executive managers.

Given the strong likelihood of congruence between senior IS executives and other executive managers on key IS management issues, the top ten IS management issues identified in the recent study by Janz et. al. provide both a sound basis of comparison for the content of current IS course offerings, and a starting point for the development of a model course. Following a discussion of course process, the results of a study comparing the content of current Executive MBA IS course offerings with key IS issues will be presented. The use of the key issues in developing the content for a model IS course will also be described.

Course Process

Course process, or modes of educational delivery, may be viewed on a continuum from passive involvement to active participation by students in the learning process. Passive learning strategies are anchored by the traditional lecture mode at one end, while the active approaches are characterized by self-directed learning experiences at the other extreme. A variety of instructional modes are possible, including modified lectures, case study, group problem solving, and student presentations.

Several researchers have examined the process component of executive education. In an assessment of the changes needed in order to produce executive education programs that meet the requirements of the management challenges of the 1990s, Verlander (1992) conducted a review of theory and research on adult learning. He contends that executives, as adult learners, are more receptive to innovative processes and active learning strategies than other groups. However, in many executive education programs, passive learning techniques exemplified by the traditional lecture still dominate.

More progressive executive education programs have adopted the case method as a learning process. Closely identified with the Harvard Business School, the case method is an active, discussion-oriented learning approach that has gained wide acceptance in graduate business education (Barnes, Christensen, & Hansen, 1994). The case approach replaces the traditional lecture by linking content and application in a simulated problem-solving scenario. The case is a factual description of a situation confronting a person, group, or organization (Bonwell and Eison, 1991). The case study can range from a highly structured exercise to a very unstructured problem that may raise a variety of complex issues and alternative solutions.

Case studies have been empirically proven to hold both advantages and disadvantages as an active learning strategy (Bonwell and Eison, 1991). Since cases are typically based on real life incidents, they allow students to vicariously experience situations they may encounter in the future. This helps bridge the gap between theory and practice. In addition, the decision-making model for case studies fosters higher-order thinking and promotes affective involvement, which can lead to changes in attitudes. The disadvantages of case studies involve the shortcomings of both the instructor and the students. The instructor must be willing to give up some classroom control and actively promote student learning. Students, frequently uncomfortable with the ambiguity and loss of rigid structure in the classroom, must possess or cultivate the ability to clearly present their point of view and listen to others.

While the use of case studies in executive education has been highly effective, it is important to note that the case approach represents only one of many course processes available to facilitate active learning in adult educational environments. Rather than rely on more traditional educational delivery modes, Verlander recommends active learning processes that are more participative in methodology, and more focused on the unique requirements of the learner. Verlander's (1992) process recommendations will be compared to the processes represented in current IS courses, and his theory-based guidelines for modifying the process dimension of executive education programs will be incorporated in the design of a model IS course.

INFORMATION SYSTEMS IN EXECUTIVE EDUCATION

One purpose of this study is to determine the current role of the IS component in executive education, specifically Executive MBA programs. The following research questions focus on understanding the current status of the Executive MBA IS course:

- To what extent is the IS course included in Executive MBA programs?
- Why has the IS course been excluded from some Executive MBA programs?
- What content and topic areas are included in IS courses currently offered in Executive MBA programs?
- What processes and learning strategies are employed in the IS courses currently offered in Executive MBA programs?

Sample and Data Collection

The 117 institutions listed in the 1993 Directory of Executive MBA Programs as offering executive education programs constituted the sample for the study. The study consisted of a mail survey and content analysis of documents gathered from survey respondents. A survey instrument was developed to capture descriptive information about IS course offerings. The instrument was pilot-tested for readability and coherence by two Executive MBA program directors and three program coordinators.

In an attempt to enhance response rates from the institutions, surveys and cover letters were mailed to both the program director and the program coordinator at each institution. Multiple responses from a single institution were compared for consistency and combined to produce one response per institution. Discrepancies between program director and program coordinator responses were rare, and were resolved through follow-up phone contact. A total of 34 institutions responded by returning survey forms, resulting in an institutional survey response rate of 29 percent.

In addition to completing the survey, participants were asked to include detailed course descriptions and course syllabi for IS course offerings identified in their response. Of the 34 institutions responding, 14 returned the requested course descriptions and syllabi. In an effort to expand the sample coverage, the use of archived Executive MBA program brochures as a source for course content data was explored.

The archived Executive MBA program information covered the period from 1991 to 1995. Each archived brochure described a full Executive MBA program, typically covering a two-year period. For example, program brochures for two-year programs beginning in 1991 provided curriculum plans ending with a spring 1993 graduation date. Program brochures that extended into 1995 contained two-year program beginning in fall 1993 and concluding with a spring 1995 graduation date. The archived data provided IS course descriptions for the most recent Executive MBA program participants, those expected to complete the program between 1993 and 1995. The most current brochures were not available for each Executive MBA program. Approximately 75 % of the brochures described programs for spring 1995 graduates, 20% related to spring 1994 graduates, and the remaining 5% covered Spring 1993 graduates. Since the majority of brochures described the most current IS course offerings, they were determined to be a viable alternative source of IS course content data.

To justify the use of the brochure course descriptions as a course content data source, the 14 descriptions/syllabi provided by respondents were compared to course descriptions collected from the archive of Executive MBA program brochures. Brochure course descriptions and respondent-supplied course descriptions for each of the 14 institutions were broken down into key phrases. The key phrases derived from each source were compared to determine the level of consistency between respondent-supplied and brochure course descriptions. For the 14 pairs of descriptions, an average of approximately 81% of key phrases from respondent-supplied descriptions was matched by the corresponding brochure descriptions. This level of consistency supported the use of the archival source data as a proxy for respondent-supplied course descriptions.

Course descriptions for the remaining 20 institutions represented among the original 34 respondents were collected from the archived Executive MBA program brochures. The archive also provided course content data for an additional 52 non-respondent institutions. The course content data collected from archival sources for 52 non-respondent institutions was combined with that of the original 34 respondent institutions to generate an effective sample coverage of n=86, or 73.5% of the initial 117 institutions surveyed.

Data Analysis and Discussion

The presentation of data analysis techniques and subsequent discussion of results are organized around the four areas represented by the research questions.

IS Course Inclusions and Configurations. The extent to which the IS course is included in Executive MBA programs is represented by the proportion of institutions offering IS courses in their programs, and by the distribution of IS courses by category (preparatory/non-degree credit course, required course, or elective course). Data from survey responses and archival sources show that IS courses are offered by approximately 77 percent of institutions supporting Executive MBA programs. IS course work functions as preparatory non-credit work in 18 percent of these programs, constitutes a program requirement in 91 percent of the programs, and is included as electives in approximately 10 percent of programs.

Of those programs offering IS courses (n=66), the majority of institutions (92 percent) offer at least one required IS course, while 10 percent offer at least 2 required IS courses. One of the institutions examined offers a unique Executive MBA in IT Management degree which requires completion of five IS courses. Overall, 66 institutions offer a total of 92 IS courses within Executive MBA programs. While exact enrollment figures were not available, most Executive MBA classes contain between 15 and 35 students.

Exclusion of the IS Course. Approximately 23 percent of the institutions for which data was available do not offer IS course work within their Executive MBA program. Respondents indicating no IS course offerings were asked to briefly describe the history and/or anticipated future of the topic within their program. Representatives from four of these institutions reported that an IS course was offered in the program in the past, but was recently eliminated. Reasons for dropping the IS course included: student evaluations indicating minimal need for the topic, retirement of faculty member responsible for the course, integration of IS topics into other courses, and consistent poor evaluations of the IS course. Course content of courses dropped included: basic microcomputing skills, overview of IS/IT, and software applications

Five of the institutions indicated that the addition of an IS course to the program is currently under consideration. The following obstacles to adding an IS course were identified: finding time in the program, lack of faculty interest in creating the course, finding appropriate faculty to teach the course, and lack of funds for information technology equipment and support. If a new IS course is added to these programs, the topics most likely to be covered include: IT strategic uses, process reengineering, management of IT and impacts on organizational design, management use of information/data for decision making, and the use of networks and databases to conduct business research. One institution also noted a plan to integrate IS topics into a new operations course.

Current IS Course Content. Of the original 34 institutions responding to the survey, 12 indicated no IS course offerings in their respective Executive MBA programs. The remaining 22 institutions were asked to indicate the topic areas covered by courses in each of three categories: preparatory, required, and elective.

The content of preparatory, non-credit IS courses appears to be limited to introductory computing skills, including microcomputer software for word processing, spreadsheets, and data management. Notebook computers, presentation software, and instruction in the use of email and the Internet were also topics reported in preparatory courses.

The required IS course focuses on an overview of computing and the use of information systems in organizations, with an emphasis on management information systems. It appears an emphasis on decision support systems and executive information systems also exists in many of the required courses. Over 10 percent of required courses also include hands-on instruction in application software, the notable difference from preparatory courses being the addition of statistical software packages. Other topics appearing unique to the required courses include the economics of information, global MIS issues, and the organizational impacts of IS. The electives reported by institutions which did not have a required IS course contained topics that are very similar to the required topics found at other institutions. Electives offered by institutions which also had a required IS course covered the strategic use and implications of information technology, organizational information systems, and telecommunications technology.

Comparison of Course Content to Key IS Management Issues. The initial discussion of IS course content suggested that key IS management issues identified by researchers form the basis for analysis of the content of current IS course offerings. The key issues shown in Column A of Table 1 relate to the expected management foci during the mid-1990s. Executive MBA students who complete the program between 1993-95 will be part of the executive management team responsible for dealing with the key issues identified by the study. Thus, it is appropriate that the IS course content of graduates from 1993-95 and anticipated IS management issues for the mid-1990s form the basis for analysis.

To determine whether the content of current IS courses is consistent with the key IS management issues executive managers must be equipped to confront, content analysis was performed on the course descriptions. First, primary noun phrases were extracted from each course description. The "uneven" levels of data created by use of brief course descriptions in some instances and more detailed syllabi in others posed a problem in this portion of the analysis. For example, a detailed course syllabus for a required course at one institution indicated coverage of WordPerfect, LOTUS, and dBASE IV, while a more general course description from a program brochure indicated coverage of word-processing software, spreadsheet software, and data management software. To correct for varying levels of data detail, more specific phrases were generalized to the next highest level. This means that when detailed items such as LOTUS 1-2-3 or MS-EXCEL were extracted, their frequency counts were combined with the counts for the phrase "spreadsheet software." This allowed directly related phrases to be combined and resulted in meaningful data reduction. A total of 96 distinct words and phrases representing the 92 IS courses offered at 66 institutions were identified following extraction and data reduction.

Second, the 96 distinct phrases were compared to descriptions of the key issues listed in Column A of Table 1. Detailed descriptions of the key issues are found in the research literature (Janz, Brancheau, and Wetherbe, 1995; Neiderman, Brancheau, and Wetherbe, 1991). In the first coding pass, direct matches between the extracted phrases and the issue descriptions were identified and the corresponding frequency counts were aggregated. In the second coding pass, single key words from the remaining extracted phrases were compared to the issue descriptions. When a match was found, the frequency counts were combined accordingly. In both the first and second coding pass, multiple assignments were possible. In the third coding pass, the extracted phrases that could not be matched to issue descriptions were compared to each other and aggregated to form more general categories. A graduate student, functioning as a second coder, was consulted in this pass. In addition to the 20 key management issues, the following topic categories were identified: computer hardware and software fundamentals, personal computing skills, overview of computing/IS in organizations, advanced information technology uses and capabilities, systems development life cycle, and management information systems. The results of the coding effort are provided in Column B of Table 1, which shows the top 20 IS topics covered in current Executive MBA programs.

The comparison of Columns A and B in Table 1 reveals the differences between recommended IS course content and actual IS course content within existing Executive MBA programs. The primary overlap occurs in the areas of: making effective use of the data resource, improving IS strategic planning, and planning and managing a communications system. The majority of the IS actual course content appears to focus on basic information systems concepts, acquisition of personal computing skills, and general IS management issues.

The content analysis technique used to map the content of current Executive MBA IS course offerings with the key IS management issues has several problems. First, the focus on IS course descriptions within Executive MBA programs ignores the IT/IS topics which may be covered in non-IS courses. Second, the test mapping between the 14 respondent-supplied course syllabi and brochure course descriptions was approximately 81% accurate. This indicates that some important IS topics may not have been included in the brochure course descriptions although they were covered in the course. Third, a significant degree of overlap between issues and topic areas appears to exist. The overlap problem is further compounded by the broadly defined basic categories such as computer hardware/software fundamentals. The limitations of the content analysis technique provide ample reason to approach the interpretation of the content comparison with caution.

Current IS Course Process. Survey respondents who indicated IS course offerings (n=22) were asked to indicate the teaching approaches and methods used in these courses. The lecture represents the dominant mode of instruction for IS courses, with 90 percent of institutions relying on this traditional mode. The second most popular mode of instruction was the case study, indicated by approximately 86 percent of respondents. Case studies are followed by small group projects as an instructional process, with about 81 percent of respondents indicating their use. Hands-on laboratory exercises (67 percent) and group discussion (62 percent) were also popular instructional processes.

A careful review of the course syllabi returned by respondents indicated that most IS courses use a combination of learning strategies. Lecture, case study, small group projects, and hands-on lab exercises are frequently employed in a single class. None of the courses represented by the syllabi appeared to be entirely case study oriented, although an average of 5 cases was covered in most courses. While the predominance of the passive lecture method is consistent with Verlander's (1992) findings, it appears that more active learning strategies are also popular in the current IS course offerings.

DISCUSSION

Given the increasing complexity of the business environment and the rapid development of potentially high impact information technologies, the proportion of Executive MBA programs without an IS component seems disturbingly high at 23 percent. This is particularly troubling since the typical Executive MBA student has an average of 8-10 years of industry experience, making it highly unlikely that the executive was exposed to relevant formal IS education during undergraduate studies in the late 1970s or early 1980s. Considering the explosion of advanced information technologies, the proliferation of IT-enabled change initiatives, and the emphasis on business process reengineering through technology, it seems doubtful that an Executive MBA program could meet the needs of top managers without an IS course.

Equally disturbing is the fact that a number of programs have decided to eliminate the IS course in the past several years, the reasons cited pertaining to "minimal need," "the assumption that the material would be integrated into other courses," and "consistently poor evaluations from students and alumni." An examination of the content of eliminated courses provides a hint of understanding as to why 23 percent of institutions may find little value in retaining the IS course in the executive curriculum. The content of these courses was typically limited to introductory topics such as computing hardware and software, personal computing skills, and an overview of the role of IS in the organization. These topics represent areas where knowledge is frequently acquired with substantial industry experience. Limiting content to these areas prevents the delivery of meaningful, relevant IS topics to executives. If IS courses were designed to introduce topics more directly linked to the needs and concerns of executives, it is likely that a high level of support would exist for the IS component in Executive MBA programs. Recent surveys certainly highlight both the need and desire for an IS/IT component in executive education (Norton, Nolan & Company, 1994)

The fact that 19 percent of programs without an IS offering are considering adding an IS course to the curriculum within the next several years is promising. The proposed topic areas are particularly noteworthy, as they focus on content more closely related to key IS management issues, such as IT strategy and the strategic uses of IT, management of IT and the IT impact on organizational design, and the use of IT to conduct business research.

Although the sample from which these courses are drawn is quite limited, a comparison of the course topics "on the way out" with the course topics "on the way in" is particularly interesting and may predict a period of transition for IS course content in Executive MBA programs. Current IS course offerings in Executive MBA programs focus heavily on low level, definitional and descriptive aspects of IS, such as fundamental concepts of computer hardware and software, acquisition of personal computing skills, overviews of computing systems/IS in the organization, and the role and contribution of IS. While these topics may provide much needed background for some executives, IS courses in this genre fall short of providing the knowledge base needed to equip executives to deal with their increasingly complex environments. More sophisticated topics such as developing an information architecture, aligning the IS organization and strategy with that of the firm, and fostering IT-enabled business process reengineering efforts are more closely aligned with the IS educational needs of executives. In addition, exposure to advanced information technologies which are key to future organizational transformation efforts will help supplement executive management knowledge currently being gathered from IS managers.

The argument for a transition in IS course content seems weakened by the experience of one Executive MBA program respondent who reported the failure of three IS courses with different content foci. However, in this instance course process may have played a significant role in the demise of the course rather than course content. The results show that the traditional passive learning model continues to dominate course delivery in executive education programs. Opportunities clearly exist to incorporate innovative learning strategies to enhance the educational experience of executives.

Prior research and the survey results described in this study indicate the need to pay careful attention to both content and process when developing and delivering IS courses for executive education. The following section describes the development and delivery of a model IS course designed to meet the needs of participants in an Executive MBA program.

A MODEL INFORMATION SYSTEMS COURSE

Researchers and theorists agree that the key to business success in the 1990s is learning how to guide the speed, direction, and intensity of strategic and organizational change (Senge, 1990; Verlander, 1992;). Executives must develop unique learning capabilities to help their businesses sustain competitive momentum. As the result of an extensive examination of the theories of individual, organizational, and adult learning, Verlander suggests several fundamental changes in executive education which he believes can help executives learn to understand new teachings about individuals and organizations while simultaneously learning required Executive MBA program content. The IS component of the Executive MBA program is undeniably imbedded in this greater educational experience, and has the potential to become an integrating force within the curriculum.

Verlander's (1992) suggestions for improving executive education apply directly to the creation of a model IS course. His recommendations form the basis for the course development guidelines and assumptions that include:

- Executives should be better prepared before participating in the course. Better preparation can even out disparities in learners' knowledge levels thereby facilitating the learning process.

- Content should focus more on the needs and actual business problems of the participants. Adult learners are motivated to learn when learning helps to satisfy personal needs and interests. These needs are the starting point for learning experiences. Furthermore, appropriate units of learning are organized around business issues and situations. They are not the sole domains of academic subjects.

- Instructional processes and delivery methods should be more participative and more learner-centered. Experiential learning must encourage the examination of the historical experiences brought to the course as well as experiences gained through the course itself. Executive learners are receptive to innovative learning strategies and executive courses provide ample opportunities to incorporate a variety of delivery approaches.

- The course should help executives discover, identify, and interpret the problems that need solving. A process of inquiry that stimulates critical examination through dialogue and personal mastery through application can enhance this self-directedness on the part of the learner.

- The impact of the course must be greater and more measurable than traditional courses at both the individual and organizational levels. Evaluation of learning must be connected in some way to measurable results.

The development of a new IS course that incorporates the theoretical tenets summarized above is discussed in the next section.

Course Development and Delivery

The development and delivery of the model course involved three primary steps: initial assessment, determination of needs and interests, identification of appropriate learning strategies and establishment of evaluation criteria. The outline of the resulting course is shown in Table 2.

Initial Assessment. The development of the model course began with a series of preliminary contacts with course participants. An assessment of the existing IS knowledge level of course participants was conducted by examining biographical information on each participant, requesting a brief written description from each participant regarding familiarity with IS tools and concepts, and informally discussing participant background. The assessment data were used to recommend preparatory reading or assignments to help ensure all participants began the course with appropriate background.

In addition, the first class session was designed to allow coverage of the more complicated or advanced background concepts deemed necessary for use in the remainder of the course. It was not possible to determine the content components of the first class until the remainder of the course was developed. This formed an essential feedback loop for ensuring participants were adequately prepared for the learning strategies to follow.

Determination of Needs and Interests. The second step in the development of the model course was a written survey of participants' needs and interests pertaining to the IS course. The objective of the survey was to generate a list of potential topics for inclusion in the course. The survey instrument listed the key IS management issues previously identified by senior IS executives (Janz, Brancheau, and Wetherbe, 1995; Niederman, Brancheau, and Wetherbe, 1991) and asked each participant to select and rank three personal preferences. Participants were also allowed to "write in" other topic choices as desired. This provided each executive with the opportunity to

TABLE 2
MODEL IS COURSE OUTLINE

Period	Theme
Week 0	**Assessment of existing knowledge levels, needs, and interests**
Week 1	**Introduction and Overview** What exactly does each participant bring to the table?
Week 2	**Management in the Information Age(Issues 2,3,9)** What do you know about the information systems function in your organization?
Week 3	**Strategic Importance of Information Technology(Issues 1,2,5,7,9)** Does the innovative use of information technology create advantages for your business unit?
Week 4	**Analyzing Existing Information Systems(Issues 2,4,8,9)** Do the existing information systems meet the needs of your business unit?
Week 5	**Developing an Information Technology Strategy(Issues 1,2,5,9,10)** Does your business unit have an existing information technology strategy statement? Is it tied to the unit's business strategy? The overall organization business strategy?
Week 6	**Information Technology Planning(Issues 1,5,9)** Can you turn the information technology strategy statement for your business unit into an information technology plan?
Week 7	**Information System Development and Executive Involvement (Issues 2,3,4,8)** What is your role in the acquisition and development of information systems for your business unit?
Week 8	**Change Management and Information Technology Implementation I (Issues 2,4,6,8)** What are the critical success factors for an information technology implementation in your business unit?
Week 9	**Change Management and Information Technology Implementation II (Issues 1,6,9,10)** How can you best implement a new information technology in your business unit?
Week 10	**Measuring the Business Value of Information Technology** What is the payoff of your business unit's investment in information technology?
Week 11	**Information Technology and Organizational Learning (Issues 2,3)** Can information technology make a meaningful contribution to reengineering your business unit?
Week 12	**Issues and Trends in Information Technology and Organizations (Issues 1,2,3,6)** How far are you from the "leading edge"?
Week 13	**Conclusion, Debriefing, and Evaluation (Issues 4,6,7,10)** How meaningful was your learning experience?

select topics to satisfy individual needs and interests, while maintaining a focus on topics that were deemed relevant and meaningful by empirical research. The aggregate rankings led to the selection of a set of topics for coverage during the thirteen-week course. Nine of the topics selected for inclusion in the course matched nine of the top 20 IS management issues. The nine issues are noted in Table 2.

Identification of Appropriate Learning Strategies and Selection of Evaluation Criteria. The third step in IS course development was the meaningful arrangement of the selected topics and the selection of processes and learning strategies designed to guide the executive through a sequence of learning experiences. This was the most difficult task in the process, because it required creative blending of the topic areas and the simultaneous development of learning measurement and student evaluation criteria.

The course outline shown in Table 2 displays the primary theme for each class period. Book excerpts and readings for each class period provided the required traditional content related to each of the topics. Below each theme is a general question that helped the executive focus and organize the learning process around an actual business situation or issue.

Although the questions may appear to be very general, they form an important component of the course design. One of the learning strategies selected for evaluation was the production of a weekly written report. Participants were instructed to read and review the written materials and consider them carefully and thoughtfully. More specifically, the connections the learner could make between past experiences, new information provided in the reading material, and discussions held in class were to be explicated and integrated in each weekly report. The question associated with each topic was designed to focus the learners' mental processes during report creation. The quality of the connections and integration of ideas in the weekly report were reflective of the level and quality of learning. The weekly reports formed the basis for 30 percent of learner evaluation.

The second learning strategy selected for evaluation was active participation in class discussions. A panel discussion format similar to a modified talk show was adopted during class sessions. A panel of volunteer discussants was formed at the beginning of each class session and the remaining participants constituted an audience. The session began with a brief statement by each discussant of observations, findings, questions, or opinions related to the session topic. Discussants had the opportunity to exchange ideas with other panel members while the audience careful observed and listened to the exchange. Following the exchange of ideas by panel members, the discussion was opened to audience input. The instructor acted as host for the discussion, facilitating the exchange of ideas and encouraging active participation with well-placed questions and guided conversation flow. Through the dialogue, executives were able to raise, interpret, or resolve numerous IS management issues and conflicts related to prior experiences, reading materials, current business practices, and future business challenges. Active class participation and panel discussion roles, gauged by the quality of conversational input, accounted for approximately 20 percent of learner evaluation.

The final learning strategy incorporated in the course involved a live field project that was conducted by each executive within a business unit of the executive's choice. The focus of the project was on learning to apply and adapt a methodology for IT-enabled business process redesign in an attempt to resolve a real business issue. The selection of a learning strategy that relied on an actual business situation enhanced the educational process in several ways. First, it helped organize traditional course topics into a more appropriate experiential learning unit. It also helped participants learn to apply and master the concepts and techniques garnered from the traditional content. In addition, it enhanced the likelihood that greater and more measurable impacts would result from the course, since project results were readily implemented.

Another important aspect of the project learning strategy was self-evaluation. Participants were required to devote a section of the final written project report to the assessment of their learning experience. Executives were asked to document and evaluate their experiences while conducting the business process redesign activities. Specifically, they were asked to comment on what part of the project methodology was most difficult, what part was most easy, what part had the most significant value, and what part was least valuable. The evaluation also provided a valuable feedback loop for future course development efforts. The project provided a key experiential learning opportunity, and formed the basis for approximately 50 percent of learner evaluation.

Course Evaluation

The model IS course described above was developed during the summer of 1993 for the Executive MBA program at an urban university in the Midwest. The course was implemented in the fall 1993 academic semester as a curriculum component for the Executive MBA Class of 1994. There were 24 students enrolled in the course. Three evaluations were conducted with respect to the model course. First, a qualitative mid-term evaluation was accomplished through the use of an informal, written format. Feedback from this evaluation allowed the instructor to adjust the course mid-semester and further enhance the participants' learning experience. Second, a separate evaluation of the project process was conducted at semester end to capture participants' perception of the impact and contribution of the learning experience. Finally, an overall participant evaluation of the course content and the course in general was conducted at semester end.

The two most valuable aspects of the class identified by participants were the open and lively class discussions, and the multiple perspectives on IS provided by the combination of course content and discussion. During the discussions the executives were able to express ideas and share varying perspectives on the same IS and organizational phenomena. They learned from exploring the "how" and "why" of business similarities and variances through their dialogue. For most of the executives, the view of the complexities of IS management was broadened and many claimed they were becoming aware of and beginning to understand the interconnections between IS and the organization for the first time. The weekly reports were also identified as being a very valuable portion of the course. The executives felt that although the report required a great deal of effort, it helped them think more critically and focus on the integration of ideas.

The evaluation of the project process was used to determine the extent of impact each executive perceived as a result of participation in the course. In general, the more likely an executive was to reuse the IT-enabled business process design methodology applied in the project, the greater the perceived benefits from the course. Overall, the model course received higher evaluations in both content and process than the previous IS course offerings in the Executive MBA program at the university.

CONCLUSIONS

The development and delivery of relevant, meaningful IS courses in the Executive MBA program has the potential to influence executive involvement in the IS management and planning process. Research shows that this involvement can enhance the benefits realized by the organization and improve organizational performance. Therefore the suggested title for the model course described in this study is "Managing Information Technology for Performance."

The burgeoning growth and importance of IT/IS is reflected in the increased attention that IT investments are receiving from executive managers. Clearly, sources of knowledge other than IS in-house staff are being sought by executives. The demand for executive education related to IT/IS indicates a continuing need for Executive MBA program IS course offerings.

The IS course also provides a potential venue for integrating, through information infrastructures, a variety of management concepts and techniques such as organization design, continuous improvement, total quality management, and business reengineering. By following a course development methodology that generates relevant, timely topics and state-of-the-art delivery methods, the IS course can help counter industry and media criticisms that executive management education is out of sync with modern business needs. In fact, the inclusion of the *right* IS course can prove that business schools are truly in touch with industry's needs for the next millenium!

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DESIGNING A CORE IT COURSE FOR EXECUTIVE MBA PROGRAMS: OBJECTIVES, STRUCTURE, DELIVERY, AND LESSONS

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INTRODUCTION

Professional development and lifelong learning are increasingly important components of organizations' efforts to enhance the knowledge and skill levels of their employees. At the same time, individual managers in organizations have come to appreciate the marketability and mobility that professional and graduate courses afford their careers. It's no wonder, then, that in North America and elsewhere, millions of dollars have been spent, and will continue to be spent, on executive business education (Brecka and Rubach, 1995). For example, a recent count of Executive MBA programs totaled 300 in U.S. News (1997).

The goal of this paper is to share our experience and insights regarding the unique challenges posed by executives in MBA programs, and how these challenges may be met insofar as the core information technology course is concerned. In order to do so, we will draw on our experience across four programs, live and on video, over the past two years, involving over 250 executive participants.

BACKGROUND

Professional development is not without its challenges. It differs from other more formal, longer duration or ongoing courses such as semester-type university courses in two ways. First, professional development courses focus on older, adult learners. Slowey (1988) points out that adult learners have usually completed some formal education and are seeking professional development courses to further their careers. They rely on their work experience as a basis for assessing the value of the learning process, and measure this value in terms of self-fulfillment. Second, the content of the learning activities is more focused and delivered in a shorter period of time. This learning intensity is due to the limited time the participants have to participate in the activities, and assumptions about the existing knowledge that participants have about the topic.

Executive MBA (EMBA) programs are typically targeted at mid- to low-senior level managers who wish to enhance their marketability and career prospects without incurring the opportunity cost of leaving their jobs for the one or two years full-time MBA programs require. They are seeking primarily to enhance their upward mobility, not change careers

EMBAs, as a subset of professional development, share a number of common characteristics with other such courses (Chung, 1991): they focus on adult learners, and the intrinsic motivation that they bring to the educational experience; they focus on a relatively narrow topic domain; and they are usually for a limited time.

The challenge, then, within the IT component of these programs, is to design a course that:

- Interests the students, successfully leverages their experience, and is relevant to the decisions they will be making.

- Is well-integrated with the remainder of the curriculum.

- Provides them the necessary knowledge, skills and abilities they will need as senior managers with respect to information technology.

- Is mindful of the time, focus, and other constraints they face as managers with demanding, full-time occupations.

Assumptions

Compared to traditional two-year on-campus MBA programs, there is an array of assumptions (and observations) that influence course design for executive MBA study.

Students
- More focused, highly motivated
- Older, more experienced
- More disciplined in their work habits
- Have competing priorities for their time and attention
- Less time for background reading
- Demand regular and personal feedback
- More focus on "here" -- (what is happening in the office?)
- More focus on "now" -- (what is happening in the office today?)

Structure
- Longer sessions
- Longer intervals between sessions
- Less face-to-face class time overall
- Only one course (eight sessions) in IT – no options available

Implications for Course Design

These assumptions have implications for course design. In executive MBA programs, the consequences of poor design can be catastrophic. So can 'sins of omission' -- tolerated by university students but forcefully dealt with by executive participants. These sins, both of omission and commission, can be avoided by incorporating students' strengths while addressing their weaknesses and anxieties directly. In our experience, a well designed EMBA course takes into consideration:

Student Learning Objectives
- High value placed on useful content
- Higher value placed on insight (A-ha!), but
- Lower tolerance for divergent learning processes

Student Attitude/Values
- Very low tolerance for 'wasting time'
- Very low tolerance for poor organization
- Very low tolerance for faculty who don't work as hard as the students

Content
- There is less content [than in a regular MBA], and
- Less time to cover the content

Structure
- Each session must stand on its own, as well as being part of a series, yet
- Links among sessions must be strong

Experience
- More experience can compensate for less content and less class time.
- There are 'experts' in the class whose knowledge may be integrated into the class experience
- The role of group study/learning is critical
- Group projects and group presentations have high value

Time
- Each session is more 'valuable', requires more preparation by the student
- Each session is more 'valuable', and requires much more preparation by the faculty.

Evaluation
- Examinations have limited value -- for both evaluation and learning
- On-going individual hand-in material has high value -- for both learning and evaluation
- Need for short feedback cycle (assignments marked and returned)
- Group activities require control mechanisms to prevent 'free riders'
- Group activities may inflate grades overall
- Group activities may reduce variance among individual grades

The Environment

Executive MBA programs have much in common. Here is the particular EMBA environment for this study.

- A classroom-based program (EMBA) and a video-conferenced program (VEMBA)
- Tuition over $30,000 per year ($50,000 for the video-conferenced program) – paid by sponsor
- Duration two years, 10 months a year (September-to-June), average of one class day per week.
- Two topics per class day (e.g. Finance and Marketing)
- All courses compulsory, no options
- Each course between eight and 12 half-day sessions
- Between 60 and 120 students in each year (e.g. EMBA Class of 99).
- Large years divided into sections of about 60 students each.
- Full time in-residence periods of one/two weeks at beginning of each semester.
- Class time about 70% of full-time MBA program
- For video-conferenced MBA, about 40% of sessions in residence -- face-to-face.
- Email available among students, faculty, and administration
- Each class year (e.g. EMBA 2000) administered by a full time manager who coordinates events, classes, timetables, resources, students and faculty.

There are further issues specific to IT:

- High variance in IT knowledge among students
- High IT anxiety among some students
- High IT arrogance/knowledge among a few other students
- Very low student tolerance for reading 800-page introductory IT texts
- Choosing a balance among IT technical content, IT industry knowledge, and understanding the role of IT (and the CIO) in organizations
- Choosing themes with which all students can identify (bridging between IT poets and IT geeks)
- Creating a design that reduces anxiety
- Creating a design that provides useful learning regardless of IT IQ
- Creating a design that evaluates relative learning, rather than absolute learning.

The Design

The design follows from these assumptions, implications, and environment. In this extended abstract we will touch only a typical half-day session, the evaluation criteria, and a schematic overview of the course. Further detail will be available in the final paper.

A TYPICAL SESSION

There are six to eight sessions to a course. A typical four-hour session has:

Two case discussions
Two group presentations

See the appended schematic outline for a course overview.

EVALUATION

The evaluation scheme is designed to minimize the penalty for IT ignorance and anxiety by allowing students to:

- (for individual assignments) conduct research to craft their response,
- (for group assignments) exploit their non-IT skills as part of a team while learning assignment content

There are four evaluation opportunities, each weighted equally.

• Class participation	(25%)
• Learning log	(25%)
• Group presentation	(25%)
• Technology article	(25%)

There is no examination.

Class Participation (25%)

This is a traditional component of a case-based course. Contribution can take many forms, not the least of which is asking questions and directing the discussion to new areas of importance. High participation grades are often achieved by "low technology" students who demand to be shown the relevance of IT for the business. This is where the extra five to fifteen years' EMBA experience pays off – both for the student and the class. Of course, if the class contains CIO, that is a bonus.

The criteria for evaluation are frequency and content.

- **Frequency**. Most students should be contributing regularly in class. This counts.

- **Quality**. A single memorable contribution can be sufficient, but most students should contribute regularly. Quality check on faculty evaluation: ask each student at the end of the course to list which [three?] student[s] have contributed most to their learning – and reward those students appropriately.

Learning Log (25%)

This document is the opportunity for each student to communicate relative learning by preparing an executive summary for each session. The guidelines are:

- one page per class, single spaced (or even handwritten)
- do NOT include class handouts, class notes
- record ideas and thoughts in several dimensions
- What did I learn? Specifically? Generally?
- What have I seen in the past that is now seen in a new light?
- What can I take back to the office?
- What have I seen in the EMBA program in other courses which links to this material?
- Etc.

Evaluation of logs is straightforward:

- **Form**. One page per session? Required dimensions included?
- **Content**. Could the student pick up the log and read it one year from now, and recapture the essence of the course from the log itself – without resorting to class notes? The answer should be 'yes'.

Group Presentation (25%)

Each student participates in a 20-minute team presentation of a leading edge technology. The teams are ready-formed as learning groups for other tasks in the EMBA program. Topics are selected from a 'leading edge technology" list. The team also prepares a two-page hand-out for the class, and a five page report for the instructor.

Evaluation is distributed among the deliverables: presentation, hand-out, and report. Usually, EMBAs respond well to strict enforcement of the required timing, form, and delivery. Not everyone needs to participate on presentation day, though it is presumed they participated in the research. The mark is a group mark.

Technology Book Article (25%)

The purpose of this task is to have each student "learn about learning about information technology". It is similar to the Group Presentation in this dimension, but it is an individual activity. They must prepare a four-page article on the IT industry, e.g. a best selling book, an industry player, new applications for management, or emerging (even embryo) technology. The articles are bound into a book – e.g. The EMBA Class of 99 IT Book– to be shared among the whole class. So far, the book is good reading!

LESSONS

The lessons from the experience reinforce the need to consider the design of EMBA courses differently from traditional courses, and similarly reinforce the onerous penalty the instructor can pay for 'sins of omission' in the execution of the design. This suggests a demanding environment where you are "lucky if you do, damned if you don't". In summary:

- This is a relationship driven activity. The concepts are sold one seat at a time. The participants expect it.
- The context must be up-to-date – which means teaching from the pages of the Wall Street Journal and -- in Canada -- the Globe and Mail.
- Leverage the participant's experience – recognize it, call upon it.
- The entertainment quotient must be high.

Finally, the instructor should recognize the multiple dimensions to the participants' loyalty and attention. They have many responsibilities, monitored and managed using a hi-tech work style: pagers, celphones, muscular notebook computers with wireless LAN cards, etc.

That being said, a successful EMBA course can be an extremely satisfying experience. There is immediate feedback, and when successful, very positive. "I have already participated in decisions which paid for the tuition" is a strong endorsement. Of course, "You really changed my life" is the instructor's wish.

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VEMBA – Class of '99
INFORMATION MANAGEMENT
Professors Peter Newson & Michael Parent
Course-at-a-Glance

SESSIONS	CASES/DISCUSSION	INTEGRATING READINGS & GLOSSARY
1 **INTEGRATION**	**Case:** Merv Griffin's Resorts	**Keen** · Introduction · Architecture
2 **TRANSFORMATION**	**Case:** Frito-Lay Inc.: A Strategic Transition	**Keen** · Chief Information Officer
3 **CONSTRUCTION**	**Case:** Century Tool & Die **Case:** Windemere Trust Co. **Presentations 1 & 2**	**Keen** · Application Software & Application Development · Systems Life Cycle
4 **DELEGATION** **Initial log due March 9, 1998**	**Case:** First Fidelity **Presentations 3 & 4**	**Keen** · Outsourcing **Case** · SAP
5 **COLLABORATION** **VEMBA '99 Book due April 2, 1998**	**Case:** Chemical Bank **Case:** Clearwater Fine Foods **Presentations 5 & 6**	**Keen** · Groupware **Install & Run** · Chemical Bank Lotus Notes Demonstration Software

SESSIONS	CASES/DISCUSSION	INTEGRATIVE READINGS & GLOSSARY
6 **VIRTUALIZATION**	**Case:** Flower Auction Westland **Presentations 7 & 8**	**Keen** · Internet · Information Superhighway **Rayport & Sviokla** Exploiting the Virtual Value Chain
7 **DISINTERMEDIATION**	**Case:** Dominion Trust **Case:** Cisco Systems **Presentations 9 & 10**	**Keen & Ballance** · Cybercash · Home Banking · Nonbank Competition to Banks in Electronic Commerce
8 **GLOBALIZATION** **Final log due June 1, 1998**	**Case:** Singapore TradeNet **Case:** CERNET **Presentations 11 & 12**	**Keen** · Electronic Data Interchange

A NATIONAL STUDY ASSESSING COMPUTER TECHNOLOGY MASTER PLANS TO MEET NEEDS OF COLLEGE STUDENTS & FACULTY

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INTRODUCTION

Modes of communication are changing, global and local networks have greatly increased in significance, and basic computer literacy is almost a universal requirement in the workplace (Rubel 1996). It has become clear that relevant education must provide students with computer tools and technologies that will be an inevitable part of their lives (Brown 1998). Our students, who will spend their working lives in the twenty-first century, must come to perceive the computer and its related information technologies as an extension of themselves, as we have so long perceived the calculator (Britt 1997).

To meet this challenge, universities should be scrambling to equip campuses with adequate hardware and software. But what is adequate? Should money be put in hard-wired computer labs when students could simply bring a laptop to class and plug into the network? Should laptops be provided? Is this financially feasible and/or justifiable in light of student demographics? Faculty development is another critical issue. Retraining of faculty is a necessity if computers are to be incorporated into all disciplines. (Candiotti 1998)

BACKGROUND

Some schools are successfully meeting this challenge. Western Kentucky University has implemented a universal computing network at a cost of $3.3 million that networks all labs, classrooms, offices, and dorm rooms (Anderson 1996). At UCLA's Anderson Graduate School of Management, students are required to purchase their own laptop and can access the network from every desk in every classroom, reading room, or breakout room (Frand 1996). Using a technology fee of $475 per semester, Valley City State University in North Dakota has placed a laptop in the hands of every student (Blodgett 1996). The University of Minnesota charges students $300 per term for a technology-access fee (Morken 1997). Drexel University simply attaches the bill for the computer to the bill for tuition (Biros 1998).

What is the impact of such fee hikes on enrollment? At Minnesota, enrollment has actually increased 20 percent in the three years since the technology-access fee was invoked. Other universities are experiencing this same phenomenon. It appears that increases in cost, offset by perceived benefits in a computer-enhanced learning environment, are acceptable to students (Burg 1998).

Some universities are receiving technical and financial support from industry to help them meet this technology challenge. IBM has implemented a Global Campus project and has set up what is known as ThinkPad Universities. Both Wake Forest and Seton Hall are participating in this project. IBM is providing products, service, and support to allow the restructuring of both administrative services and teaching and learning environments. Each freshman receives a notebook computer for an extra $1000 tuition at Seton Hall, $3000 at Wake Forest (this price tag will also help offset training costs). Internet and university network access is available from dorm rooms. These computers will actually be owned by the university, to allow fast response to complaints concerning damaged or defective equipment. Every computer in inventory will be replaced every 2 years. Seton Hall estimates that this project will cost $15 million over the next 5 years. (Guy 1997)

Since few schools have the luxury of support from a corporate giant like IBM, the vast majority of universities need a consistent, ground-up strategy that starts with long-range plans for computer purchase and distribution, networking, training, maintenance, and curriculum development. Some schools that have such plans have been very successful in their implementation. Others schools are building a technological Tower of Babel. A national survey that assesses where universities are in their attempt to meet the technology challenge may help all schools better understand this challenge and permit them to be better equipped as we approach the next century.

The primary purpose of this study is to designed to gather information concerning programs that are in place to address increasing academic computing needs. This study should generate data that will (1) provide valuable information concerning strategies that universities and schools of business in general are using to meet demand for computer hardware, software, and printing; (2) identify master plans and programs being pursued to satisfy anticipated future needs; and (3) address programs in place that coordinate the migration and/or retirement of existing computers.

RESEARCH METHODOLOGY

A survey instrument was sent to all deans of all 792 AACSB member schools. In the cover letter, the investigator explained the purpose of the study and included the survey instrument (see Appendix A) as well as a request that the survey be passed on to the individual who is most qualified to complete the questionnaire. One hundred, thirty-five surveys were returned for a 17 percent response rate.

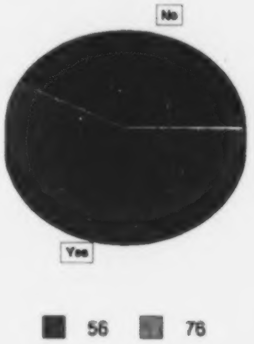
These surveys were summarized using SPSS for Windows. In addition to frequencies, SPSS was used to ascertain whether or not there was any significant differences between responses from universities that had master plans in place to address future technology demands and those universities that did not. Chi square goodness of fit tests were also used to compare universities that had plans in place to address the migration and/or retirement of existing computers and information technologies and those universities that did not.

FINDINGS

Over half of the schools that responded have plans in place that allow them to meet technology demands in the future and that address the migration and/or retirement of existing computers.

To summarize the results of the survey instrument, most schools dispose of old computers by recycling them, generally using state funds for new equipment purchases (see Table 1). Almost all schools support computer labs and Microsoft Office. Few require that students purchase laptop computers. The vast majority of schools have teaching labs, generally with ink jet printers available in the labs, which are manned by technicians. While most schools do not charge for printing, many have imposed a student technology fee (45.2% with the median fee being $50 per term). The majority of those responding to the survey either have docking stations or have plans to install docking stations within their labs. Most are not moving to a paperless classroom at this time. The majority of schools are trying to standardize software as well as hardware. For a breakdown of responses by question, see Appendix A.

MASTER TECHNOLOGY PLAN



MASTER RETIREMENT PLAN

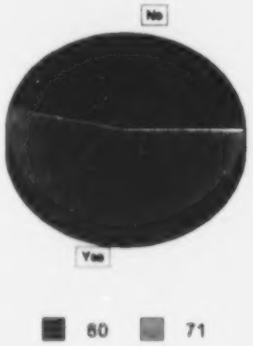
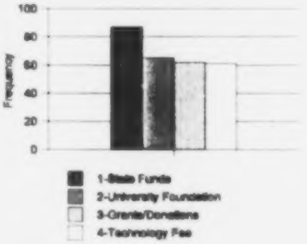


TABLE 1
FUNDING OF NEW EQUIPMENT PURCHASES



Seventy-six of the 135 universities responding have a plan in place to address future technology demands. These plans varied, but many stated that a university committee oversees the spending of technology monies and that this committee assesses and prioritizes needs. Additional issues addressed in master plans included:

1. Increasing monies dedicated to improving instructional technology, including distance learning and high tech classrooms equipped with data projectors capable of computer/video and audio projection.
2. Yearly equipment purchases, with computer labs receiving top priority in equipment replacement and old equipment being filtered down to academic offices.
3. Moves toward laptop computers (some schools hope to require students to purchase laptops in the near future).
4. Building infrastructures that allow every class, every desk, every dorm room to be connected to the Internet.
5. Standardization of hardware and software.
6. Increase the amount of budget monies available for technology needs.
7. Strategies that allow schools to take advantage of the power of the World Wide Web, movement toward Web based instruction in the classroom.
8. Increase in the use of such collaborative tools as Lotus notes.
9. Year 2000 compliancy.

Seventy-one of the 135 universities responding have a plan in place to address the migration and/or retirement of existing computers and information technologies. These plans varied, but most proposed a time frame in which hardware would be replaced.. To summarize these plans:

1. Twenty-seven percent stated that replacement of equipment was performed on a three-year cycle.
2. Thirteen percent replace equipment on a four-year cycle.
3. A few schools replace equipment on a two-year cycle.
4. One school reports that lab equipment is placed annually, another that one lab is replaced each year.
5. Another noted that equipment is upgraded, not replaced.
6. Most noted that old lab equipment (with most schools stating that new equipment went first to labs) was filtered down to faculty (based on classes taught and research agenda) and departmental offices. One stated that old equipment was placed in typing labs.
7. Several schools have moved to lease agreements and no longer purchase equipment.
8. One school stated that replacement costs are born by both the college needing the equipment (25% of expense) and the students using the equipment (75% of expense).

Chi-square goodness of fit tests were run to compare master plans in both meeting future needs and in the retirement and/or migration of old equipment to all other survey questions. In comparing schools with and without formal plans to address future technology demands, eight questions were significant at the .05 level (see Table 2). Universities that did have formal master plans on meeting needs of the future were significantly different from other universities in the following areas:

1. Of universities that donate old equipment when no longer useful, 70% have master plans.
2. Of universities that require that students purchase laptops, 91 % have a master plan. In fact, of universities that provide a laptop to students, 100% have a master plan.
3. Of universities that use technicians to man computer labs, 66.7% have master plans.
4. Of universities that plan to move to a paperless classroom, 75% have master plans.
5. Of universities that have formal plans for the retirement of old equipment, 81.4% also have master plans.
6. Of universities that are attempting to standardize printers, 66.2% have master plans.
7. Of universities that support laptop computers, 79.2% have master plans.

8. Of universities that support both laptop computers and computer labs, 81.8% have master plans.

In comparing schools with and without formal plans to address the retirement and/or migration of existing computers and information technologies, ten questions were significant at the .05 level (see Table 3). Universities that did have formal master plans for the retirement of old equipment were significantly different from other universities in the following areas:

1. Of universities that donate old equipment when no longer useful, 66% have master retirement plans.

2. Of universities that finance the purchase of new computers and/or software using foundation/endowment accounts, 63.5% have a master retirement plan.

3. Of universities that have a master plan to address future technology needs, 77% have a master retirement plan.

4. Of universities that handle technology maintenance with full-time technicians provided by their college or school of business, 62% have master retirement plans.

5. Of universities that have technicians manning their computer labs, 62.1% have master retirement plans.

6. Of universities that have plans to move toward a paperless classroom, 77.4% have master retirement plans.

7. Of universities that are attempting to standardize computers, 63.4% have master retirement plans.

8. Of universities that are attempting to standardize printers, 70% have master retirement plans.

9. Of universities that support laptop computers, 73.9% have master retirement plans.

10. Of universities that impose a student technology fee, 63.3% have a master retirement plan.

TABLE 2
TESTS OF SIGNIFICANCE MASTER PLANS FOR MEETING FUTURE NEEDS

Dependent Variable:	Independent Variable:	Pearson's r
Plans for future technology needs	Donate retired computers	.040
Plans for future technology needs	Laptops are required	.010
Plans for future technology needs	Labs are manned by technicians	.010
Plans for future technology needs	Plans to move to a paperless classroom	.030
Plans for future technology needs	Master plan for retirement of old equipment	.000
Plans for future technology needs	Attempting to standardize printers	.040
Plans for future technology needs	Supporting labs and laptops	.010
Plans for future technology needs	Supporting laptops	.015

TABLE 3
TESTS OF SIGNIFICANCE MASTER PLANS FOR EQUIPMENT RETIREMENT

Dependent Variable:	Independent Variable:	Pearson's r
Plans for equipment retirement	Donate retired computers	.040
Plans for equipment retirement	Finance equipment with foundation $$	.050
Plans for equipment retirement	Have master plans for future needs	.000
Plans for equipment retirement	Use full-time technicians from within COBA for maintenance	.050
Plans for equipment retirement	Man computer labs with technicians	.020
Plans for equipment retirement	Intend to move toward paperless classroom	.005
Plans for equipment retirement	Are attempting to standardize computers	.001
Plans for equipment retirement	Are attempting to standardize printers	.000
Plans for equipment retirement	Support laptop computers	.040
Plans for equipment retirement	Impose a technology fee	.050

CONCLUSIONS

In the face of rapidly changing technology and dynamically increasing computer hardware and software needs, universities need to formally address how they will meet demands in the near and distant future. Industry is expecting employees to be more than simply computer literate, students are scrambling to acquire these skills, and the universities who meet this challenge will have the opportunity to shape education in the 21st century.

All universities must accept budget constraints. These monetary limitations force all colleges, departments, faculty, and staff to fight for each dollar allocated. Technology needs continue to swallow a larger and larger slice of the pie. To be equitable and to place a university in a competitive position in years to come, a formal master plan needs to be devised that will address the monies allocated to technology needs and how these dollars will be best spent.

Many universities are implementing such plans. These plans address dollars budgeted, equipment purchases, standardization of hardware and software, infrastructures that will allow students Internet access from most anywhere, high technology classrooms, Web based instruction, software tools, and laptop computers. This is a checklist about which every university is or should be concerned. It is interesting to note that when a Chi Square Goodness of Fit Test was performed, there was no significant difference between the size of the university and whether or not the university has a technology master plan. Nor is there a significant difference between universities with master plans in place when examining whether or not a university has AACSB accreditation. Nor is there a significant difference between universities with master plans in place when examining whether or not a university is public or privately funded. All universities are recognizing the needs for such a plan.

For the most part, equipment retirement or migration is tied in with technology master plans. Addressing the cycle of equipment replacement and the migration of existing equipment is a necessary part of most technology plans.

As the turn of the century beckons, we are experiencing sweeping changes in how information is stored, retrieved, processed, and delivered. Universities must incorporate this evolving technology into their labs, classrooms, and classes in order to be have the competitive advantage in recruiting students. How this technology and computer equipment will be made available is best addressed through a comprehensive plan that maps out goals and objectives for the university. Those universities with pragmatic approaches to ensuring up-to-date hardware and software will be academic leaders in years to come.

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APPENDIX A
ASSESSMENT OF COMPUTER TECHNOLOGY MASTER PLANS

1. Is there a plan in place that will allow your college to meet future technology demands?
   57.6% Yes
   42.2% No
   If so, please provide a brief overview of your master plan or attach a copy of the plan to your questionnaire.
2. Is there a master plan in place for the migration and/or retirement of existing computers and information technologies?
   54.2% Yes
   45.8% No
   If so, briefly describe your master plan or attach a copy of the plan to your questionnaire.

3. How do you dispose of retired computers? (Please check all that apply.)
   39.3% sell computers
   54.1% recycle
   34.8% donate to charitable organizations
   38.5% other (please specify: return to university warehouse)
4. What sources of funds do you use to finance the purchase of new computers and/or software and printers? (Please check all that apply.)
   45.2% student technology fee (if so, the fee per term is $50.00)
   45.9% grants/donations from industry/vendors
   64.4% state funds
   48.5% university foundation/endowment funds
5. Are you supporting computer labs and/or requiring laptops for students and faculty?
   94.7% labs
   18.3% laptops
   16.8% both
6. If you require students to have a laptop, is this provided and paid for by means of tuition?
   8.9% must purchase
   2.2% is provided
   84.4% not required
7. Do you have teaching labs?
   97.7% Yes (if so, number of labs 2 with average number of workstations 25)
   2.3% No (go to question 8)
   If yes, do your college labs support (Please check all that apply):
   94.7% Microsoft Office
   10.6% Lotus SmartSuite
   28.0% Corel Word Perfect
   What hours are labs open?
   48.9% until classes end for the day/evening
   38.9% until midnight or later
   2.3% 24-hours a day, except weekends
   9.2% 24-hour days, 7 days a week
   .8% times varies with each semester

   Are these labs manned by technicians?
   67.9% Yes
   32.1% No
   If yes, the number of technicians working full time is 3
   the number of technicians working part-time is 6
   How does your college handle printing demands of students and faculty? Are there printers in the labs?
   97.7% Yes
   2.3% No
   If yes, what type of printers do you have? (Please check all that apply.)
   93.3% laser
   26.0% ink jet
   16.8% dot matrix
   3.8%
   Are your students charged for printing?
   25.4% Yes
   74.6% No
   Are docking stations available in your labs for student laptops?
   13.1% Yes
   47.7% No, but they will be in the future
   39.2% No

8. Does your college intend to move towards a paperless classroom?
   25.4% Yes
   74.6% No
   If so, how do you plan to accomplish this?
9. Are you moving toward any of the following means of standardizing computing technology? (Please check all that apply.)
   88.1% standardizing software
   70.1% standardizing computers
   53.7% standardizing printers
10. How do you handle computing technology maintenance? (Please check all that apply.)
   50.4% trained student workers
   64.6% full-time technical support provided by your university
   54.8% full-time technical support provided by your college or school of business
11. Is Year 2000 compliance an issue for your college?
   50.0% Yes
   50.0% No
12. Approximate number of students at your university
   10.7% 0-2500 32.1% 2501-7500 26.0% 7501-15,000
   16.8% 15,001-25,000 14.5% over 25,000
13. Is your university
   71.1% public 28.9% private
14. Does your university have AACSB accreditation?
   65.4% Yes
   34.6% No

SITE VISITS AS A TEACHING METHOD IN INFORMATION SYSTEMS COURSES

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This paper provides a substantial introduction to the use of site visits as a form of live case study on IS courses. Site visits are relatively easy to organise and can effectively complement other teaching methods. Importantly, students like the reality of site visits and the variety they bring to a course. Site visits can be a meaningful encounter for students that encourages active learning. They provide rich opportunities for students to explore theory and practice. For students with relatively little business experience, site visits can expose them to the complexity of organisational life. Site visits can also help educators to keep up to date with current practices and problems.

INTRODUCTION

Many IS educators use written case studies within their teaching and Huff et al make a strong argument for using case studies. At Canterbury, we use written case studies in our courses, but we also use live case studies in the form of site visits. These site visits complement and reinforce the learning gained through lectures, readings and written case studies. Student feedback indicates that site visits have been a most valuable part of one of our courses, so we recommend them to IS educators.

What is a site visit? A site visit is type of field trip, which has been a popular teaching method within the sciences for many years (Gold & Haigh, 1992). A typical site visit is a one-off visit for the whole class to a local organisation. Its most important elements are presentations from senior management and opportunities for open discussion about how the organisation manages their IS. In addition, many site visits include a demonstration of a strategic information system and, particularly for manufacturers, a short tour of part of the site so that the students can gain a better appreciation of their business, products and processes. The presentations by senior managers typically discuss major products/services, the industry, business strategy, as well as the use and management of IS. Most site visits would take about 3 hours and finish with a minimum of 30 minutes for open discussion.

We include site visits as part of our undergraduate course[1] titled "management of information systems and technology". The course is taken mainly by students undertaking a three year Bachelor of Commerce degree, although not all the students taking the course intend to become IS professionals. The focus of the course is on organisational issues, including: IT and competitive advantage, IT strategy, IS planning, and change management. Site visits are well suited to this course and we are sure this approach could be adopted and adapted for other IS courses, including systems development/analysis and design.

The Site Selection Process

Typically we approach a firm's IS manager at least two months before we would like to visit them. Many want time to think about it but some accept or decline straight away, and others request to be considered for later in the year or for the following year. Most appreciate an email or letter to outline the purpose of the visit, etc. (see appendix 1).

We try to make sure that we visit a range of firms each year. For example, we try to ensure that we visit at least one firm that is in the IT industry, eg, a software house; at least one firm that is in the not-for-profit sector, eg, local government or hospital; at least one service firm, eg, insurance or consulting; and at least one manufacturer.
We include up to 6 site visits during our 25 week course. The site visits are in addition to the scheduled weekly class time of two hours per week. With 35-40 students in

the course, some visits are limited to 20 students, often because the organisation does not have a large meeting room. Occasionally the 'visit' has been split into two sessions; the first as an in-class talk to the whole class by, eg, the IS manager, followed by a visit to the firm. We schedule the visits throughout the year; for example, one in term 1, one or two in term 2, two or three in term 3, and one or two in the final term.

We have a local population of 300,000 people with a reasonable manufacturing presence, but with no single dominant employer. There are very few local organisations with over 1000 employees. Most local organisations are small, and many of these are too small and not suited to host a large group of students. In addition, many national firms may have a local branch but with no significant IS presence. Despite these limitations, we have found that there are more than enough local organisations for worthwhile visits, but we tend to re-visit the larger organisations on a 3 or 4 year cycle.

There are very few IS departments in the region with as many as 30 staff. Therefore we often include firms where no IS development takes place, and as few as 2 or 3 people may have any formal IS education. This is not a problem for us as the focus of the course is IS *management* rather than IS *development*.

Active Learning

ISWorld's pages on Teaching Information Systems with Active Learning Techniques[2], edited by Nelson, refers to many papers that provide support for using active learning approaches with IS students. For example, the pages include a quote from Zelda Gamson[3] on 'active learning':

> The evidence is very strong that these social forms of learning are very effective in increasing retention, encouraging much more complex thinking about complex issues than we have come to expect from our students, and encouraging acceptance of different ways of learning on the part of students and faculty. The motivation for learning goes up [when these approaches are used]. [However] these kinds of approaches don't happen automatically; in fact, they need to be very carefully designed. It isn't just a matter of getting people together and having them discuss (NTLF, May 1996, 5:4).

There are others whose arguments support the use of active learning to enrich a student's educational experience. For example, Boud et al (1993) argue that "experience is the foundation of, and the stimulus for, learning" (p. 8). They add, "while we commonly assume that teaching leads to learning, it is the experiences which teaching helps create that prompt learning, not primarily the acts of the teacher" (p. 9).

Why Use Site Visits?

The desire to encourage active learning is in itself a significant reason for us to continue to use site visits. However, site visits can be viewed as live case studies, and have some similar benefits to case studies, as outlined by Huff et al:

> cases can help students develop their ability to deal with complex, ambiguous situations;
>
> cases can motivate students to take greater responsibility for learning;
>
> cases can help students integrate learning across management disciplines.

In addition, site visits provide students with insights into the business world which would be difficult to gain in any other way. Importantly, students can gain insights into organisational strategy, culture, structure, and personalities. This is not only important for their formal education but also when making career choices. Students also gain insights into organisational complexity, thus helping them recognise that the task of managing, including managing IS resources, is not simple. Site visits can also help to illustrate IS theory.

The Unpredictable Nature of Site Visits

Compared with written case studies, the teacher has less control over the content of a site visit as it is difficult to predict what will be discussed and seen on a site visit, although it is possible to request some content. Occasionally it is possible to know a sufficient amount about the organisation's IS to be able to schedule a visit at an appropriate point in the course. For example, last year we scheduled a visit to a local manufacturer who had recently outsourced their IS operations; we made sure that the visit was just before we were to discuss the outsourcing chapter in the text.

Often we have to approach an organisation that we know little about. Despite this uncertainty, such visits can work well, or often better than expected. Memorable visits include a brewery, where they outlined their IS planning process just one week after we had been discussing IS planning in class[4]. A recent trip to our local city council outlined management practices such as charging for IS services, planning, and cross functional teams. That visit occurred the day before the scheduled class meeting for many of the same issues.

Typically, the timing of site visits with respect to lecture topics is not an important issue as a visit usually raises a number of very different issues that span the course. By the end of the course we use the visits to identify links between theory and practice. This is very helpful as it encourages us to look at the whole course, make connections between topics, and revisit significant topics.

Important Differences Between Site Visits and Written Case Studies

Site visits can be viewed as live case studies where you meet some of the participants and gain their view of their world. However, unlike many written case studies, a site visit can not guarantee that students will be presented with a problem situation that requires a decision. Thus a site visit is unlikely to offer a situation where a full case analysis is required, including a set of alternatives which are then evaluated. This is one reason why we include both written case studies and site visits in our course. One must bear in mind that a site visit presents only a partial view of an organisation as students hear from only a very small number of staff; a written case can present the views of many.

Another significant difference between site visits and written case studies is that site visits require very little prior preparation by students[5]. This can ease the burden for students who are not sufficiently motivated to fully prepare for a regular diet of case studies. We do not require attendance[6] at site visits and currently the course assessment is based directly on the site visits.

Another advantage that written case studies have over site visits is that cases can more easily support a virtual classroom. If a course is offered by distance education then it would be most difficult for everyone to gain the same experience from a site visit. Although students can be encouraged to collect organisational data as part of a project or an assignment, an IS educator can gain access to levels of management which could be more difficult for a student to obtain.

How to Encourage Learning on Site Visits

Like any in-class situation, a site visit does not guarantee that student learning will take place; because of this we have used a range of approaches to encourage students to reflect on and analyse the organisation. Our current practice is aimed at encouraging students to make notes while on a visit and to analyse each firm soon after the visit. We then devote up to 20 minutes of the next formal class to discuss significant topics. This discussion is aimed at sharing insights and is centred around:

- major decisions or events. Students are encouraged to raise other topics, for example, attitudes, culture, and roles.
- how various theory applies to the organisation.

More formally and towards the end of the course we schedule 30/40 minutes per organisation for a group presentation and discussion. This encourages students to reflect on the organisation in relation to the whole course. We encourage students to focus on a significant topic where the site visit can add to our understanding. (For further details see Appendix 3.) This is a particularly appropriate end of course activity as the presentations tend to focus on a range of topics, and thus provide a unique overview of the course prior to the final examination.

In the past we have also sought individual and group reports to encourage student learning; such reports are no longer required. This change was not for pedagogical reasons but primarily to keep the total number of assessed items for the course to three. Additionally, it is unclear whether such forced reflection does in fact increase student learning (Boud & Walker, 1993).

Student Feedback

Student feedback indicates that site visits are a highly valued part of the course. We have received encouraging student feedback about site visits for many years and we report below some of last year's feedback from the 27 students who attended the final session for the 1997 course and completed the course evaluation questionnaire.

The questionnaire included an open ended question, "what are the best aspects of this course"? A total of 16 students responded to this question. Of these, 10 students mentioned "site visits", often as part of their first comment, and for some it was their only comment. Responses included, "site visits", "site visits very valuable", "site visits gave real life examples".

Another part of the course evaluation questionnaire asks for a set of 11 statements to be rated on a five point Lickert scale, from strongly disagree to strongly agree. Among these are three statements that refer to some of the different teaching methods used on the course: site visits, case studies and the text/readings. The statements were:

- the site visits were a valuable aid to my learning.
- the case studies were helpful in clarifying the material presented in lectures.
- the text and/or required reading assisted my learning.

Although the questionnaire and its statements were not designed to test the relative effectiveness of the three different teaching methods, the data does provide some basis for comparison. The descriptive statistics for the student ratings of these three statements is given in the top part of Table 1. Site visits had the highest mean (3.93 v's 3.59 and 3.07), ie, students agreed that site visits were valuable. Using one way ANOVA, the scores can be considered different (Table 1). Paired t-tests show that the site visit scores were statistically higher at the 5% level compared with written case studies (Appendix 4) and with the text/readings (Appendix 5). This analysis supports the general conclusion that students view the site visits as a most important part of the course.

Students like site visits for many reasons. For example, students appreciate their exposure to the realities of organisational life. Past comments from students include: "the field visits were an excellent chance for us to see it as it is in the REAL world of IST and business"; "field visits give a great practical view. I find these very interesting"; "field visits - practical experience of what happens in the 'real world' ".

Students also appreciate the role that site visits can play in their learning, as evidenced by these comments from past students: "practical site visits and/or illustrations balanced the theory quite well"; "the case studies & site visits help to reinforce the theory".

Comments like these indicate that site visits may suit students' learning preferences. Oliver & Morrison (1991) argue that many Commerce students prefer participatory learning; they want to discuss things and have opportunities to express their views. Site visits enable such opportunities as each student can form their own interpretation of events, which they can discuss at the time and in subsequent classes.

Benefits: The Educator's View

From a teacher's perspective the site visits are a valuable part of the course as they complement other teaching methods in many ways. For example, they add variety to the teaching methods, get us out of the classroom, and provide some very local content.

Most importantly, site visits are nearly always interesting and often memorable. They tend to provide examples that are still relevant long after the visit. This shared

TABLE 1
ANOVA COMPARING THE THREE SOURCES OF LEARNING

Single Factor Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
visits	27	106	3.926	0.764
cases	27	97	3.593	0.558
text	27	83	3.074	0.609

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	9.950617	2	4.975	7.727	0.000868	3.113797
Within Groups	50.22222	78	0.643			
Total	60.17284	80				

experience also helps build a good student/staff relationship. Although quite a few colleagues use occasional guest lecturers from industry, few use site visits so the visits are a unique feature of our course.

There are also some direct benefits for teaching staff. For example, site visits can contribute to personal development, by helping staff keep up to date with current practice and problems. Often, data gathered on a site visit can be used as an illustration in many different courses. In addition, a visit can help build relationships with the business community, including potential sites for research.

CONCLUSIONS

Feedback from students over many years has encouraged us to continue to include site visits as part of our third year paper on the management of information systems and technology. Arranging visits is relatively easy and well worth the investment of time. We recommend this practice to other IS educators as a way of adding variety and reality to their courses. Although we have only included site visits within our undergraduate course titled "management of information systems and technology", we are sure visits could be used with other IS courses.

ENDNOTES

1. http://www.afis.canterbury.ac.nz/outlines/co30398.htm
2. http://academics.smcvt.edu/mnelson/isworld/ACTIVE-L.HTM#implement
3. Professor of education and director of the New England Research Center for Higher Education at the University of Massachusetts in Boston.
4. the free beer was also a first for the course.
5. However, Boud & Walker (1992) argue that "greater use can be made of learning events if learners prepare first" (p. 165).
6. An important contextual factor is that many stage 3 courses at our University include three hours of class contact per week; typically two hours of lectures plus a tutorial or laboratory. Our course meets for two hours each week, plus the occasional site visit. Thus the course's total number of hours (25*2 plus 5*3) is less than for many other courses (25*3), so importantly, the site visits are part of the total, not an extra load.

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APPENDIX 1
A DRAFT EMAIL TO AN IS MANAGER
(which would follow a phone contact)

Thanks for considering us for a visit.
some background info. most students are in the final year of a Commerce degree. many will soon seek employment as IST specialists, and others with IST as support, eg, as accountants.
the focus of the course is on organisational issues associated with information systems and technology. we are keen to understand how IT fits into the goals and values of the whole organisation. so we are not just interested in the IT department's perspective. thus it often helps if various parts of the organisation are involved in a site visit in some way.
the objective of the site visit is to expose students to real world managerial problems and issues, and thus help students recognise the complexity of making IT work effectively for an organisation.
by September the course will have covered many topics relating to the management of IST, including IT and competitive advantage, IT planning, systems development, build v's buy, managing end user computing, and electronic commerce. thus by September the students should be well able to understand your experiences, practices and problems.
I would much appreciate you considering a site visit for the morning of 16 September, preferably from 10-12noon. and to involve not just IT staff but also at least one user manager. a demonstration of a particularly significant system can help, maybe combined with a short tour.
I look forward to hearing from you and thanks again for considering us for a visit.
best wishes

APPENDIX 2
EXTRACT 1 FROM THE COURSE OUTLINE

Format of Site Visits

A. Advance Information

A Site Visit is preceded by the provision of a brief description of the organisation concerned, and its Information Systems & Technology (IST) environment. This may include:

- Background information from the annual report or equivalent.
- An organisation chart showing how the IST function fits into the organisation.
- Main applications at present
- Main projects currently proceeding
- Hardware and software being used.

Lastly, the advance information should include the programme for the Visit, address, a sketch showing how to get there, contact names and job titles. Ideally, one copy per student, handed out the week before the visit.

B. Programme

The programme for a Site Visit ideally includes the following:

1. A talk by the IST Director on the challenges, achievements, and plans of the IST function. (About 30 mins).
2. A middle-management client view of information systems and their use within the organisation. (About 30 mins).
3. A senior management view of information systems, and plans for its future use. (About 30 minutes).
4. A Question & Answer session. (About 30 mins).
5. Demonstration of a business application or decision support system. (Time permitting).

C. Areas of Special Interest

Examples of subjects that might be in the programme are:

- Overall planning for Information Systems and Technology,
- Use of the computer in the organisation's competitive environment,
- The process of selecting systems projects and investments,
- The human side of systems,
- The systems methodology/lifecycle,
- Project management,

- Productivity tools,
- Data security & integrity,
- Network management,
- High level systems such as executive/decision support,
- The use of systems in reducing cash and inventory needs, improving customer service, and enhancing competitive advantage.

D. Analysis

Students are expected to ask questions during the Visit and take notes. The visits provide another opportunity for students to develop their organisational analysis skills.

E. Companies Visited

Some of the companies Visited in recent years include Fletcher Steel, LWR Industries, AMI Insurance, Mount Cook Group, Foodstuffs S.I., Milburn NZ, PDL, Gough Gough and Hamer, Trust Bank, Tait Electronics, MM Cables, South Island Dairy Farmers, Canterbury Area Health Board, Telecom South, Lyttelton Port Company, Cardinal Network, Contec Systems, Fortex, Canterbury Regional Council, and Christchurch City Council.

APPENDIX 3
EXTRACT 2 FROM THE COURSE OUTLINE.

Group Site Visit Presentation Guidelines

1. The main purpose of the Group Presentation is to add value to the site visit by analysing the organisation in the light of the 303 course material. You are likely to need to gather additional data to do this. You should take a managerial perspective. Demonstrate that you understand IST theory by applying appropriate theory to the firm. Highlight problems, analyse major issues, justify recommendations. Focus on their IST managerial practices. How do they manage IST? Are these approaches appropriate? What do you recommend?
2. Each team or group should be of not less than three nor more than four people. Students are required to organise themselves into groups by the end of Lecture 03, and advise names in writing to the Course Supervisor at that time. Each group is encouraged to organise itself for optimum effectiveness.
3. Each group is assigned the responsibility of presenting and reporting upon one of the organisations visited in the Site Visits. These assignments are made by the Course Leader. All members of the group must attend that Site Visit.
4. The final presentation sessions are scheduled for Term 4, as per the Course Schedule. Each group presentation should last no longer than 40 minutes, including questions. A practice 'dry-run' beforehand is highly recommended.
5. Each group can play the role of a consulting team reporting back to a senior partner (the Course Supervisor) and consulting colleagues (other students at the presentation session) of a consulting firm. The presentation could be a dress rehearsal before making a client presentation. In the spirit of this role-playing, each team member could come to the presentation session in business attire. All members of a group are expected to participate 'up-front' in giving the group's presentation.
6. A good presentation is where the group: (a) is well-prepared, (b) has analysed the organisation and is now able to add value (possibly through extra evidence), to the site visit, (c) is knowledgeable about the organisation and its analysis based on course material, (d) speaks clearly, (e) explains well, (f) responds well to questions and (f) makes effective use of the overhead projector and/or other visual/graphical media. As with case studies, your presentation should emphasise key issues, relevant theory, and concentrate on analysis rather than description. Any student who simply reads word-for-word from written material risks being asked to sit down. Cue cards and visual aids may be used.
7. Those students not involved in a presentation at a particular session are not required to attend that session. However, they are encouraged to attend. Those students who are involved in one of the session presentations are required to attend the whole session.

APPENDIX 4

t-Test: Paired Two Sample for Means: site visits vs case studies

	visits	*cases*
Mean	3.923	3.593
Variance	0.764	0.558
Observations	27	27
Pearson Correlation	0.247	
Hypothesised Mean Difference	0	
df	26	
t Stat	1.732	
P(T<=t) one-tail	0.048	
t Critical one-tail	1.706	

APPENDIX 5

t-Test: Paired Two Sample for Means: site visits vs text/readings

	visits	*text*
Mean	3.926	3.074
Variance	0.764	0.609
Observations	27	27
Pearson Correlation	0.234	
Hypothesised Mean Difference	0	
df	26	
t Stat	4.311	
P(T<=t) one-tail	0.000103	
t Critical one-tail	1.705616	

THE EDUCATION OF IT PROFESSIONALS: INTEGRATING EXPERIENTIAL LEARNING AND COMMUNITY SERVICE

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This paper begins by describing the changing needs in the education of today's IT professional. It presents a theoretical framework for using an experiential learning approach in the context of professional education in IT and information management and describes an instructional model that augments the principles of experiential learning with principles drawn from task motivation, Total Quality Management (TQM), and service learning. The paper concludes with an example of the application of and benefits from the model---a successfully implemented IT professional education program which centers on experiential learning activities that provide technology-related services to the not-for-profit community.

INTRODUCTION

With the establishment of universities in thirteenth century Europe, a parallel education track, separate from the existing apprenticeship system, developed. This type of education adhered to the "empty vessel" metaphor (i.e. the student as passive recipient of knowledge), an approach still followed in many of today's schools and universities.

The relatively slow expansion of knowledge made this a reasonable approach in the past. It was realistic to expect that students could graduate with a thorough grounding in the theory of their profession, enter practice with an established organization, and learn their field under the tutelage of an experienced professional. Today this paradigm is not a realistic response to the demands of many fields, including the information professions.

In this paper we describe changing needs in IT professional education and present a theoretical framework for implementing experiential learning activities into professional educational programs in IT and information management. We then describe an instructional model that augments the principles of experiential learning with principles drawn from task motivation, Total Quality Management (TQM), and service learning. We conclude with an illustration of the application of and benefits from the model---a successfully implemented IT professional education program which combines experiential learning and service to the not-for-profit community.

IT PROFESSIONAL EDUCATION

Rapid technological advances and the concomitant expansion of research and knowledge have forced specialization upon the professions and continuing education a critical requirement for professionals. Graduates entering professional life are expected to "hit the ground running", capable of working individually or in teams to immediately apply their theoretical knowledge to solve real problems. Today, more than ever, employers are seeking workers who (1) possess problem solving and reasoning abilities, (2) can listen and respond to customer concerns, (3) can make decisions and develop innovative solutions, (4) are goal-directed, and (5) can work in teams (Parnell, 1990; Carnevale, Gainer, and Meltzer, 1988). In the field of information management, there is an unprecedented demand for trained professionals that have both a general theoretical grounding in the technology of information management, and proven ability in the application of book knowledge to practical problem solving.

Compounding the challenge of meeting this demand is the rapid rate of change in the field and the broad range of commercial off-the-shelf (COTS) solutions available in an information systems and telecommunications (hereafter IT) environment characterized by two influential paradigms: client/server computing and open systems. While these two paradigms, which are inter-connected and interdependent in significant ways, have helped make IT solutions to a large extent interoperable and affordable, they have also complicated the process by which IT solutions are identified and adopted by customers.

Before client/server computing and open systems, the decision-maker had to pick and choose from a limited set of IT options, most were proprietary in nature. Typically, the vendor offered complete solutions, and once the decision had been made by the customer, the vendor was brought in for the implementation. Under the new paradigm, the customer is faced with a wide range of IT choices and strategies, which often promise competing approaches to solving a problem or meeting a need. For example, a customer contemplating a move to a local area network-based operating environment has to consider whether to implement the solution using a fat or thin client, a peer-to-peer or server-based network operating system, a conventional or wireless communications system, a high-end or low-end hardware platform, and whether to pick an enterprise-wide solution or something smaller in scope. Increasingly, customers are assembling a solution using components from different vendors, with an eye toward price, robustness, support and scalability.

Under this new paradigm, IT professionals are being asked to take on the role of consultant (internally or externally) to help customers make the right choices from the welter of options available to them. Pre-professional students must be exposed to learning activities that require them to actively interpret, integrate and apply the knowledge, skills, and attitudes they learn to real-life settings.

Although many of today's pre-professional students typically graduate with a solid theoretical knowledge, they often lack experience in applying that knowledge to solve real problems in real settings. The traditional passive approach to professional education has produced graduates with the problem-solving skills and attitudes required for (1) understanding and applying concepts and principles learned and (2) successful professional practice. A balanced approach that integrates theoretical knowledge with real-world experiences would likely improve the overall readiness of these fledgling professionals. Ideally, this approach would provide students with the supported learning environment of an apprenticeship, where an experienced and knowledgeable professional provides help and guidance and the student solves real problems for real clients. This is the paradigm of experiential learning.

THE THEORETICAL BASES OF EXPERIENTIAL LEARNING

The terms "active learning" and "experiential learning" are often used interchangeably in the literature to refer to the use of direct experience to instruct students in applying methods and theories learned in the classroom. Drueke (1992) defines active learning in terms of active participation or student involvement that results from a variety of teaching techniques. Active learning encompasses a broader range of potential activities from in-class discussions and interactive exercises to out-of-class internships and fieldwork, including experiential learning environments that focus on hands-on activities or place the student in real or simulated problem situations that require resolution. Keeton and Tate (1978) describe the experiential learner as one who is directly in touch with the realities of that being studied, as opposed to learning in the abstract. Wagemans & Douchy (1991) describe two types of experiential learning: (1) prior learning (knowledge and experience gained outside the classroom that the student brings to the learning situation) and (2) sponsored learning (knowledge and experience gained throughout the learning situation, planned and supervised by the instructor but occurring outside the classroom).

Perhaps the most widely published work on experiential learning is that of David Kolb. Kolb, building largely on the theories of Dewey (e.g. 1938), Lewin (e.g. 1935), and Piaget (e.g. 1929) and focusing on the adult learner, defines learning as "the process whereby knowledge is created through the transformation of experience" (1984, p. 38). He defines experiential learning as the process that links education, work, and the personal development of the learner: "(k)nowledge does not exist solely in books, mathematical formulas, or philosophical systems; it requires active learners to interact with, interpret, and elaborate these symbols" (Kolb, 1984, p. 121). The basis, therefore, of experiential learning is the recognition that learning takes place everywhere, not only in the classroom.

Kolb describes learning in terms of a four-stage cycle that progresses from concrete experience to reflective observation to abstract conceptualization to active experimentation which then leads to subsequent concrete experience, and so on. In the concrete experience stage, the learner is actively involved in a formal or informal learning event. During the reflective observation stage, the learner thinks about, questions, sorts out, clarifies, and classifies the events of the concrete experience stage (Thatcher, 1990). The learner then begins to transform these reflections into abstract ideas which are "stored" in the mind for future use (Thatcher, 1990). The final stage, active experimentation, requires the learner to draw upon this store of abstract ideas to apply in a new learning experience. The learner may enter the cycle at any point but Kolb maintains that every learning experience must involve all four stages. Usher (1985) further claims that the learner does not progress through these stages spontaneously but rather requires guidance from an instructor.

Progress within these learning modes results in increasingly complex learning environments. Affectively complex learning environments emphasize experiences that exemplify "what it is actually like to be a professional in the field under study" (Kolb, 1984, p. 198). Behaviorally complex learning environments emphasize actively applying knowledge or skills to a practical situation. Perceptually complex learning environments emphasize relationships between conceptual understanding, information seeking, and problem solving. Symbolically complex learning environments are characterized by applying abstract reasoning to complex problems.

Although strongly supported in the literature, Kolb's ELT is not without its critics. Hopkins (1993) argues that Kolb's approach is not based on any coherent theory of experience. Jarvis (1992) has pointed out that, contrary to ELT's central tenet, not every experience yields learning. Merriam and Clark (1991) argue that persons learn from experience only when that experience is attended to, is reflected on, and has personal impact. Merizow (1991) has argued similarly, noting that active reflection, as opposed to passive observation or non-reflective experimentation, is essential before individuals can benefit from experience; otherwise, no learning will occur. Clark and Wilson (1991) criticize ELT's relative neglect of the social and cultural context within which experiential learning takes place, arguing that ELT's exclusive emphasis on human agency without the context of learning is short-sighted.

We believe that Kolb's ELT is valuable in the context of higher education, and particularly in the professional education of information managers and technologists. However, we believe that Kolb's ELT needs to be augmented with two important features before its value for IT professional education can be fully realized. These two features, which we have incorporated into our successful implementation of active learning (described below), are: (1) an identifiable customer for the deliverables resulting from the active learning experience, and (2) an identifiable product which provides the task context for the active learning experience. Both these features enhance the motivational benefits of ELT to the student – a perspective that appears to be overlooked in discussions of ELT processes and impacts; for example, the focus of most evaluative studies of ELT on students in higher education is on cognitive benefits and on self-efficacy, not motivation. We believe that active learning experiences that result in an identifiable deliverable for an identifiable customer are more motivating and more satisfying to the student than those that do not.

Both features have theoretic merit. Several writers on Total Quality Management (TQM) principles have noted the powerful motivational impetus provided by an identifiable customer (primary customer) who receives the deliverables and to whom suppliers are accountable (e.g., Wood, Hull & Azumi, 1983). Award-winning TQM programs like those of Xerox emphasize customer-oriented effort as a fundamental and central tenet (Venkatesh et. al., 1996). The nature of the deliverable itself has been studied within the framework of task motivation (Hackman & Oldham, 1980). Tasks that (1) result in a complete product (as opposed to only a part of a larger product), (2) call for skill variety, (3) provide immediate feedback, (4) have significance, and (5) are divisible promote higher levels of motivation relative to tasks that lack one or more of these dimensions (see Hackman & Oldham, 1980). To the best of our knowledge, these two features have not been considered under ELT. Our end-of-semester evaluations show that students consistently report high levels of motivation and satisfaction stemming from these two features.

EXPERIENTIAL LEARNING AND IT PROFESSIONAL EDUCATION

It is surprising that experiential learning appears to be neglected in recent discussions of required IT/IS skills and the extent to which higher education is equipping students with these skills. A joint industry/academic study found that industry now demands IS professionals with knowledge and skills in technology, business operations, management, and interpersonal skills with an end-user-focus (Lee, Trauth and Farwell, 1995). "...(U)niversities must be more innovative in designing their IS programs in order to add breadth, depth, and relevance to the curriculum" (p. 334). However, this study ignored the key role experiential learning opportunities can play in upgrading the relevance of IT/IT curricula. Reviews of pedagogical approaches in IS/IT (e.g., Leidner & Jarvenpaa, 1995) have also neglected the role of experiential learning, despite the strong practitioner foundations of the discipline.

In a review of active learning research, Hendrickson (1984) found that active learning techniques were highly effective in higher educational settings. In an early examination of professional programs and their foci in several disciplines, including management, Schein (1972) identified several problems, noting that professional programs (1) focused on organizational needs and largely ignored user needs, (2) provided almost no training/opportunities to students to work in teams engaging complex social problems, (3) included little instruction in diagnosing and managing client relationships, and (4) failed to include ethical and value issues. Improvements have occurred in a few of the areas identified in Schein's analysis. Professional programs which "focus on the integration of basic science, applied skill training, and practical experience and which permit an interdisciplinary focus on client problems are essential if clinical practicum work is to become more innovative and effective" (Schein, 1972, p. 119).

In our experience, experiential learning programs sensitive to the motivational needs of student learning and designed to serve the community via student involvement in team projects can be very effective in combining rigor and relevance, cognitive and motivational gains, business values and community service values of sharing and cooperation, action and reflection. A number of experiential learning activities that bridge the gap between theory and application may be found in professional education. Examples are internships, simulations, case studies, mentoring programs, apprenticeships, and cooperative education programs. These activities allow practical applications of the abstract concepts and processes learned in the classroom and offer several advantages: (1) colleges can gain private sector support for active learning programs; (2) students practice technical skills while learning specific applications; (3) students gain increased employment opportunities; and (4) industry benefits with future employees with ready-made competencies (Leitzel, 1995).

EXPERIENTIAL LEARNING AND COMMUNITY SERVICE

A renewed spirit of volunteerism and community service has been advocated from leaders in business and industry, education, and government; service learning initiatives are permeating educational programs from middle schools to graduate schools (Slavin, 1996). "Service learning" is a type of active learning focused on learning while serving in the community. "Service learning involves students in real-life settings where they apply academic knowledge and previous experience to meet real community needs" (Fertman, 1994, p. 8). The term service learning can be loosely defined as an educational activity, program, or curriculum that seeks to promote student learning through experiences associated with volunteerism or community service. Successful service learning is based on active learning, which is characterized by very different behaviors on the part of both teachers and students.

Experiential learning initiatives can provide a critical complement to classroom learning, increasing students' understanding, confidence, and problem-solving skills, and enabling them to take risks and be change agents in their organizations (Kolb, 1984). Combining active learning experiences with a community service context not only promotes the student's intellectual development but also his/her social/moral development because it (1) enhances classroom instruction through real-life experience, (2) reinforces the concept of service-learning and the values inherent in community service, and (3) reinforces the values inherent in sound business practice (e.g. customer orientation, effective leadership, teamwork, professionalism). Furthermore "(a) good service learning program helps participants see their questions in the larger context of issues of social justice and social policy---rather than in the context of charity" (Kendall in McDaniel, 1994, p. 29). For example, some law schools send students out into the community to work with social service agencies, thereby providing students with a rich personal experience while making a meaningful contribution to society (Slavin, 1996).

Zucca, Freund and Wollesen (1993) assert that experiential learning activities provide a deeper, more purposeful, thoughtful, and value-oriented participation in public life. Fertman (1994) advocates (1) the integration of service learning into the curriculum, (1) service learning should earn college credit and (3) teaming students with experts in a field and having them work together on real projects as one of the best ways to learn. Students have been found to develop empathy for the people with whom they work and thus reduce stereotypical views and social distance. Students also enhance their sense of responsibility. Students seem to develop more complex ways of analyzing a problem as a result of service learning courses. When service learning projects are of value to community clients and are rooted in the subject matter, students show greater mastery of the conceptual material than when the projects do not have these characteristics. Few evaluative studies have found it important to examine the motivational benefits to students from experiential learning. As argued above, the TQM and task motivation literatures point out that undertaking a consequential task with real deliverables for a real customer is a key motivator. In light of this, the neglect of motivation in explaining the benefits from experiential learning to the student is surprising, given the key role played by motivation in cognition and learning (e.g. Ames and Ames, 1989).

EXPERIENTIAL AND SERVICE LEARNING IN AN IT PROFESSIONAL EDUCATION PROGRAM

Many authors recognize the value of IT in the non-profit sector. For example, Henderson (1985) points to the efficiency and effectiveness gains from IT use, enabling non-profits to provide better services, while Zeff (1996) argues the value of access to the World Wide web for more effective fund-raising. Others have talked about improved financial management (Gelatt, 1992; Young, 1994), improved communications and information access (Duronio & Loessin, 1993), and improved ability to deal with change (see Drucker, 1989). However, non-profits generally appear to face several impediments to using IT effectively. A recent survey reported that more than 70 per cent of the agencies surveyed did not have access to a technical consultant to help them plan for and deploy IT (Williams, 1990; see also "How you and other non-profits are using technology: latest survey results", 1996). Lack of training opportunities in IT (Williams, 1990), lack of awareness about IT's importance (see Beckley et al., 1996), lack of funding, leading to dependency on donations of IT equipment, which in turn leads to an ad hoc IT environment characterized by systems integration challenges, costly maintenance, and challenges in standardization (see Beckley et al., 1996; Overman, 1990).

Overall, while IT has revolutionized work in modern organizations, this revolution has yet to penetrate the non-profit sector. This is particularly true of the smaller non-profits. Typically, non-profit agencies are underfunded and understaffed, their employees generally lack technical expertise, their access to computer resources is severely limited and their need for those resources is profound, and opportunities for affordable technology procurement, training, and consultation are rare. Scholars have indicated the difficulty in defining the term "non-profit organization (Anheier, 1995; Overman, 1990; Hall, 1994; Gelatt, 1992). We adopt the following working definition, which corresponds to that used in most state statutes: "A non-profit organization is an organization whose goal is something other than earning a profit for its owners. Usually its goal is to provide services" (Anthony & Young, 1990, p. 216). From this definitional perspective, we include human and health service agencies, K-12 schools, school-to-work programs and adult education agencies, government agencies, law enforcement, and arts and cultural entities such as museums.

Key success factors in introducing IT into the non-profit sector are no different from when the for-profit sector is the target: careful planning, monitoring, and evaluation of the implementation effort. Specific needs include analysis of client's objectives, needs and resources, assessment of technology solutions available in the market, solution design and development, implementation (including end-user training) and both formative and summative evaluation. The key difference, of course, is that the non-profit sector is resource-constrained in a way that the for-profit sector.

THE CENTER FOR ACTIVE LEARNING AT SYRACUSE UNIVERSITY

Syracuse University's mission---to create a student-centered educational environment within the context of a major research university---focuses on five core values of quality, caring, diversity, innovation, and service. Community outreach and active learning which goes beyond the classroom are emphasized as teaching and learning goals.

The School of Information Studies at Syracuse University offers high quality, innovative, interdisciplinary academic programs in information and library science, telecommunications and network management, and information resources management. The School's user-centered focus advocates the integration of classroom instruction, technology applications, and real-world experiences into an interdisciplinary educational environment. This integration is operationalized by the School's Center for Active Learning, which was established in early 1997 with corporate support.

The Center for Active Learning (CAL) incorporates the School of Information Studies' focus on users and user information needs and serves the spirit of community service. CAL was established to help non-profits, especially the smaller non-profits, meet these IT challenges by providing IT consulting and related services free of charge to the client.

CAL is based on the following simple yet profound concepts:

- The holistic development of the student is paramount.
- Service learning enriches the community, enriches the learning experience, and benefits the university.
- Active learning is an important component of a balanced curriculum.

CAL is focused on meeting the IT needs of non-profit agencies of central New York State by incorporating public and community service activities into the learning experiences of students. CAL promotes the value of community service as an integral part of the educational experience by providing (1) IT consulting and related services, and technology transfer services free-of-charge to non-profit agencies in the community, (2) active learning experiences to students, (3) course and curriculum development services to faculty and (4) research and evaluation information to the field.

CAL's active learning experiences are designed to promote the holistic development of the School's undergraduate and graduate students. Its primary learning objectives are (1) to help students develop the conceptual and practical skills needed to be informed consultants and leaders of IT and managers of technology transfer and (2) to foster students' attitudes of service and volunteerism. It allows students to see a direct benefit of their contribution, to follow a project through from conception to implementation, and to work collaboratively with clients, faculty and peers. The primary vehicle for achieving these learning objectives is the field consulting project (taken for course credit) where students work in small consultant teams to provide clients with a completed product or service that resolves a IT problem or addresses an opportunity. The broad range of IT consulting and related services provided by CAL to clients include:

- hardware and software evaluation, selection, and installation.
- network planning, design and installation.
- database design and development.
- Web page design and development.
- end-user training.
- strategic planning.
- procurement and vendor selection.
- community needs assessment.

CAL taps the power of experiential learning in the context of community service to benefit the student, the client and the community at large through its five core functions. These are:

- Community Outreach. Via the semester-long field consulting project, student consulting teams provide clients with a completed product designed to resolve a problem or address an opportunity. CAL's technology transfer function is also a part of this.
- Hands-on Experience. The field project provides students with hands-on consulting experience in the context of real problems faced by real clients. In addition, CAL's Business Applications Educational Lab (called the BAE Lab) provides an experimental setting to promote learning-by-doing.
- Software Simulation. The BAE Lab features network planning and design decision aids, notably simulation software. Training on such aids enables students to present clients with thoroughly researched and well-documented design recommendations.
- Faculty and Curriculum Development. CAL seeks to enrich the teaching/learning process by facilitating the integration of active learning and community service strategies into a broad range of courses in the School of Information Studies and by promoting continuous improvement of such strategies via research.
- Research and Information Dissemination. CAL promotes research into active learning and the development of a case study base, serving as a forum for archiving and sharing information in support of community-wide benchmarking, and the refinement of a replicable model of a higher education-community partnership initiative.

By participating in CAL's projects, students have the opportunity to learn by doing in a low risk, supported environment. Faculty have an opportunity to enrich theories and concepts taught in the classroom through real-life examples and experiences. Non-profit clients receive free IT consultation and training from competent, knowledgeable and highly motivated students, who see themselves as consultants in training. The university strengthens its relationship with the community. CAL's corporate sponsors receive positive publicity and help fulfill their community service initiatives. The latter is frequently accomplished through CAL's Project CORE.

CAL'S PROJECT CORE

CAL's Project CORE (standing for COmputer REuse) seeks computer donations from the corporate sector to be given to non-profit agencies. In addition to the material benefits to the recipient, students are providing a broad range of value-added services that include:

- cleaning hard disks and readying donated computers for use.
- listing and explaining each computer's capabilities.
- researching and recommending ways to upgrade processor performance and strategies for memory, storage and BIOS upgrades, including vendor and pricing information and procurement options.
- recommending ways to use computers in a local area network (LAN) and to access the World Wide Web.

Project CORE (student) staff work in conjunction wth CAL to design and deliver a total solution to the client: that is, the consulting and end-user training services augmented with actual implementation of the solution by CAL teams, using Project CORE computers. Over fifty computers have been donated under Project CORE since last October. In the spring of 1998, Project CORE launched an ambitious program of donating 1,000 additional computers to the non-profit sector in the community by the year 2000. We are calling this Project CORE's 1000 by 2000 goal.

OTHER CAL PROJECTS

CAL has initiated a number of other projects that provide support to its main objectives. These include:

- serving as a test-bed for advanced technologies, such as asymmetric digital subscriber line (ADSL).
- sponsoring a colloquium that brings together all of CAL's major partners (faculty, students, not-for-profit agencies, corporate sponsors) to explore various topics of interest.
- developing a database management application to track information (including evaluation data) pertaining to clients and projects.
- developing a document database to organize the over 100 case studies and related materials generated by CAL's student teams.
- growing the BAE Lab into a exciting studio environment for team-based learning-by-doing.

PARTICIPATION IN CAL

Students can work on CAL projects in two ways: enroll in courses that require students to work in interdisciplinary teams on CAL class projects, and/or work on CAL special projects through independent study, internship opportunities, or simply as interested volunteers. Over the past several years, over a hundred IT class projects for clients in the community have been completed through courses in telecommunications projects, local area networks, systems analysis, end-user training, project management, and database management. Interested faculty have redesigned their courses to incorporate CAL-related projects; i.e. projects focusing on (1) IT consulting: helping clients determine their hardware and software needs, and with procurement, implementation and use issues, (2) actual implementation and testing of solutions, or (3) end-user training. Two examples of "CAL courses" are briefly described below.

"Telecommunications Projects," offered at both undergraduate and graduate levels, is primarily an IT consulting course with a focus on IT infrastructure issues. This course is the vehicle through which CAL vision was initially tested in 1991. The major course assignment is the field project assignment. Students working in small teams provide consulting and related services to an identifiable real client, in the context of a project topic they pick to work on. Student team reports for the assignment are required to be organized under two broad components: planning and design. Under planning, students analyze user requirements, constraints (budgetary, physical etc.), organizational objectives, and the technical and human resources infrastructure. Armed with this knowledge, student teams research available technology solutions and options in the marketplace and recommend a cost-effective solution to the client. Student teams have to not only recommend a solution, but they have to defend their choice in the report, and provide complete pricing and vendor information in appendices. Increasingly, repeat clients have needed actual implementation services combined with the consulting and related services.

End-of-semester student evaluations have been very positive, emphasizing the motivational advantages of working on a real, consequential project for a real client that really needs help. Project topics have covered a wide range: telecommunications planning and design, systems and network integration, office automation, Intranet design and development, communications services for remote access, and Internet access design options. Close to 35 non-profit agencies have served as clients to this class alone in the past several years.

"Instructional Strategies and Techniques for Information Professionals" is a graduate-level elective course in the School of Information Studies. It is particularly relevant to those who intend to enter a career field in which education or training is an important and/or major function (e.g. information systems coordinator, school librarian). The integration of students from the School's various graduate programs assures a rich synthesis of perspectives encompassing service, management, and technology.

The course purposefully integrates all four types of Kolb's (1984) complex learning environments. Students are teamed with local non-profit organizations to meet their specific training needs. In the classroom, students gain a solid foundation in the theory and methods of designing, implementing, and evaluating instructional presentations and materials, as well as opportunities to practice methods and skills through in-class exercises with instructor and peer feedback. Students must analyze the complex training needs of their clients and develop viable solutions. Out of class, student teams are required to meet with clients to assess technology training needs, design appropriate training interventions and evaluation mechanisms, deliver one or more training sessions, and create related support materials (training manuals, job aids). Often, the projects provide follow-up to previous CAL projects in which student teams selected and installed software.

The instructor of this course fulfilled the two roles specified by Kolb (1984): (1) teacher of essential concepts and techniques and (2) facilitator, providing a learning framework through informal meetings and classroom seminars. Some examples of student projects are:

- instructing the staff of a child care agency how to use a newly installed email system .
- training social workers from the country health department how to create and use spreadsheets.
- teaching teachers from a local school district how to design web pages.
- Introducing a set of new medical databases to employees of a not-for-profit teaching hospital.
- training staff of a school for the arts on the use and application of presentation software.

In the fall of 1997, 24 students enrolled in this course. Seven non-profit agencies in need of technology training addressed students during the first class session. Students selected the agency with which they would like to work, creating teams of 2-4. A pre-project questionnaire administered at the beginning of the course determined that most (17; 81%) students expected to have experiences working with real people and solving real-world problems and expected to find the experience personally satisfying and fun. The two major concerns voiced by students were (1) a lack of balance of effort put forth by each team member (13; 62%) and (2) time/scheduling of team meetings and training sessions (10; 48%). In order to address these concerns, the instructor (1) regularly monitored each team member's participation throughout the semester and factored participation into each student's final course grade and (2) allocated a portion of class time for team meetings.

A post-project questionnaire revealed that all students (24; 100%) believed the experiential approach enhanced their learning and that they had achieved their personal learning goals. Their biggest problem (10;42%) had been in communication with the client (e.g. some clients did not return phone calls, meeting times were suddenly changed), a real-world problem facing by consultants in most fields.

Sixteen students (67%) felt participation in these projects increased their interest in community service. Examples of student comments are:

- "It gave me a way to learn more about and work with an organization that has held much interest for me professionally."
- "It's nice to feel like you're giving something back to the community---especially since many times they would have trouble affording training from a 'professional' organization."
- "Working with people who had a real need and knowing I was providing a service rather than just completing a project for a grade made this experience much more meaningful."

Clients were asked about their satisfaction with the results of the projects. All clients (7; 100%) stated their expectations had been met or exceeded.

Both of these experiential learning examples successfully addressed the two important motivational features described earlier. They (1) are customer-oriented, focusing on and satisfying a real need and (2) result in a completed, significant product.

CONCLUSION

It has been said that the "paradigm that is likely to characterize college classrooms of the future envisions a place where quality and mastery are the reigning values, where students work harmoniously with classmates and professors toward shared goals, and where professors are guides and mentors to students who are applying their learning in a variety of "real world" contexts and are evaluated by the products of their work" (McDaniel, 1994, p. 30). The incorporation of experiential learning via team-based project work into professional education programs gives students opportunities to apply theoretical knowledge and practical skills learned in the classroom to solve real-world problems. Experiential learning projects that serve the IT needs of the non-profit sector help develop students' attitudes of community service, build teaming skills, and foster a spirit of volunteerism, besides addressing a key lacuna in the non-profit sector.

CAL offers a theoretically grounded program to incorporate experiential learning into professional higher education, and augments ELT with two important motivational principles: one centering on the customer, and the other on the deliverable. Howe (1997) observes that "to change from passive to active learning…is very difficult, for both students and teachers because the ruts they are in are familiar and comfortable". It is important to keep the motivational aspect of instruction and learning in view in light of the novelty of active learning, which may initially deter students. CAL represents a successful initiative designed to realize the vision of the professional school of the future, and offers a viable model for integrating classroom learning, IT, real-world experience, and community service to promote the holistic development of the student.

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MEASURING STUDENT SATISFACTION WITH INSTRUCTIONAL TECHNOLOGIES IN MIS CLASSROOMS

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This research is an attempt to measure student satisfaction with instructional technology in MIS classrooms. Fundamental to this task is the validation of instruments for measurement of service quality for use in a classroom setting. The researchers investigated those conditions that separate education, which takes place in classrooms, from other service conditions. SERVQUAL has been adapted for a variety of settings including those that encompass all of the differences between classroom environments and ordinary services. The researchers conclude that SERVQUAL can be adapted to this different environment. The researchers develop an instrument inspired by SERVQUAL to measure student satisfaction with the instructional technologies used in their MIS classrooms. The instrument is fit for use in other disciplines with little or no modification.

INTRODUCTION

Much has been written about how to use high-technology tools in management information systems (MIS) classrooms. Less has been written about how students benefit from or *perceive* they benefit from the use of that technology. In today's highly competitive market for higher education, high service quality is necessary to protect competitive advantage. Since MIS students are consumers of education when they enter a technologically modern classroom, they are consumers of technology. But the focus of most prior work is more pedagogical than satisfaction oriented. The researchers have found no studies measuring service quality within an individual classroom or in specific MIS courses. Although not without flaws, SERVQUAL is a well-established instrument for measuring service quality. Validating the tools that measure student consumer satisfaction with classroom instructional technology is the focus of this project.

The long-run purpose of this research is to determine the effectiveness of information technologies in higher education classrooms. One dimension of that effectiveness is consumer satisfaction—how satisfied are the students who are the consumers of instructional technology being used in the MIS classroom. The intent of this research is to provide faculty with evidence to help them choose instructional tools appropriate to their course content and pedagogies. But the researchers must first establish the validity of SERVQUAL and related instruments in the classroom setting.

The literature review which follows has four parts: first, a look at the literature on the original SERVQUAL instrument and some of its criticisms; second, a review of research on non-SERVQUAL assessments in higher education; third, adaptations of SERVQUAL to specialized settings and SERVQUAL's use as a perceptions-only instrument. The literature review concludes with a short summary of works which study the instructional technologies themselves.

Following the survey of literature is an analytical section covering the fitness of SERVQUAL in a classroom setting. This section explores whether and how students, instructors, and classrooms differ from other services and service settings. This section includes a brief discussion of the wide range of SERVQUAL applications (which does not include a classroom setting). The researchers conclude that SERVQUAL can be adapted and validly used in this setting.

The third major section describes the researchers' plans to build an instrument for measuring service quality—actually consumer satisfaction—regarding the instructional technology component of MIS classrooms. This unfinished experiment leads to this paper's conclusions and recommendations.

REVIEW OF THE LITERATURE

Much has been written about the measurement of service quality. Indeed, Buttle (1996) reported some 1447 service quality articles in a two-year period. The service quality concept includes a dimension of consumer satisfaction which relates well to the researchers' construct "student consumer satisfaction." The most promising research thread in the extensive literature related to service quality is concerned with the SERVQUAL instrument (Brown, Churchill, & Peter, 1993). SERVQUAL is based on the principle that service quality can be best assessed by considering it from the point of view of consumers (Buttle, 1996). Van Dyke, Kappelman, and Prybutok (1997) built an IS-context modified version of SERVQUAL to assess quality of services supplied by an information services industry. While SERVQUAL studies have covered many service sectors, no articles were found which applied SERVQUAL to a classroom setting (Buttle, 1996). Ford, Joseph, Joseph (1993) report one of the few uses of SERVQUAL in educational settings; their research does not investigate service quality within the classroom.

Parasuraman, Zeithaml, and Berry (hereafter referred to as PZB) (1991) originated SERVQUAL. SERVQUAL is a 22-item, two-part scale which has become a popular method of measuring customer service quality. One of the most significant contributions of their work has been to conceptualize service quality as a multi-dimensional construct. In particular, PZB contend that service quality has five basic dimensions: tangibles, reliability, responsiveness, assurance, and empathy. While empirical tests of the SERVQUAL instrument have not always distinguished clearly among these five dimensions, the strengths of both the PZB conceptualization of service quality and the SERVQUAL instrument have essentially led to their institutionalization in the service quality literature.

Methods other than SERVQUAL exist for measuring student satisfaction. Joseph, Ford, Joseph and Brooksbank (1995) used focus groups and interviews as means of ascertaining the determinants of quality. In recent years the American Association for Higher Education (AAHE) has been active in collecting the results of experiments and anecdotes in the use of instructional technology. Their work is summarized in AAHESGIT #29 (Gilbert, 1998). Gilbert relates studies done by Rehak, Ehrmann, and others. Rehak wrote on the importance of good experimental design in evaluating effects of instructional technology. Only a small amount of literature exists related to student satisfaction with the use of technology. AAHESGIT #101 reported that the University of Glasgow has performed numerous studies of the effects on students of teaching software in various disciplines. In some studies, students prepared confidence logs, an approach similar to measuring student satisfaction (Gilbert, 1997).

Modifications and adaptations of the SERVQUAL instrument are widespread and are even practiced by the instrument's originators (e.g. ZBP, 1996). A modification of SERVQUAL was developed to incorporate customer expectations of desired service and adequate service. The modified three-part SERVQUAL was tested in the computer manufacturing, retail chain, and automobile insurance and life insurance sectors." Modifications resulted in improvement in measuring customer satisfaction.

Use of only part of the SERVQUAL structure, specifically omitting expectations but leaving perceptions, is supported by Teas (1994) and Brown, Churchill, and Peter (1993). Van Dyke, Kappelman, and Prybutok (1997) quoted a 1993 article by Boulding in which he noted, "results demonstrate that service quality is influenced only by perceptions."

Van Dyke, Kappelman, and Prybutok (1997) found several articles that expressed concerns as to whether SERVQUAL can apply across industries. They summarized Carman (1990), who found it necessary to drop as many as 14 items of the 22 and add 13 more to capture the service quality construct in various settings. They reported Brown, Churchill, and Peter (1993), who felt that SERVQUAL omitted several items critical to measuring service quality in banking and that "simple" adaptation of SERVQUAL would not be sufficient. Van Dyke, Kappelman, and Prybutok (1997) concluded that using a single measure of service quality across industries is not feasible, and that future research should involve development of industry-specific measures of service quality.

Finally, the authors provide from the literature a brief mention of the instructional technologies themselves. Kleen and Shell (1996) reported on the impact of instructional technology on classroom delivery in MIS classrooms and identified most frequently and least frequently used classroom technologies. Miketta and Ludford (1995) and Khalifa and Limayen (1994) both reported on increased student *performance* in the presence of IT, but did not deal with student satisfaction levels.

ANALYSIS

The researchers plan to measure service quality in MIS classrooms. However, since students are not analogous to consumers, the researchers must investigate whether instruments designed for consumers will work in classroom settings. This groundwork is necessary for several reasons. First, the student is, directly, a consumer of education, and only *indirectly* a consumer of the technologies that deliver education. Second, the student is part of a group, not a single individual demanding and consuming the technologies. Third, the student may not be a voluntary consumer. Fourth, the instructor is not positioned analogous to the seller.

How are students different from typical consumers?

- Consumption not direct: In taking a specific MIS course, the student does not pick the specific technologies that deliver course content
- Consume in a group: All students present in the classroom get the same service
- Not fully voluntary: In choosing a business major, students take required, not voluntary, courses in MIS
- Professor not analogous to seller: The instructor evaluates the student while no seller evaluates a consumer.

The researchers' task is to determine whether these differences are important in deciding the validity of SERVQUAL. Below are examples gathered from previous reported research. The researchers noted the wide range of services measured.

Banking
Information systems
Retailing, including tires, apparel, etc.
Computer Manufacturing
Public recreation
Real Estate brokering
Car servicing
Local government
Business schools
Higher education
Life Insurance
Automobile insurance
Appliance repair
Hospital services
Dental clinics
Accounting services
Architectural services
Airline catering
Travel and tourism

In this list are some examples of (1) indirect consumption of technology (banking), (2) group consumers (public recreation), (3) not fully voluntary consumers (car repair, and hospitals), and (4) atypical service deliverers (real estate and other professional services). There are also examples within education, but they do not reach into individual classrooms or specific disciplines.

In each of these examples, SERVQUAL dealt with one of the four differences. SERVQUAL has been used where two or more of the differences are present. Car servicing contains the "not voluntary" and the "indirect" circumstances. There is no reason these exceptions cannot be stacked one on another and all four differences be present at once. The classroom is such a setting. The researchers conclude that SERVQUAL can be used in a classroom setting.

The researchers propose to measure classroom service quality with a battery of items inspired by the dimensions of service quality identified by PBZ (1998, 1991). Unlike SERVQUAL, these items are not "difference-score based" or "gap-based," but rather focus only on the *perceptions* of students as consumers of classroom instructional technology. They do not include student expectations of desired or adequate service.

The 19 items proposed are presented below. The researchers *a priori* grouped questions 2, 5, and 10 into the Reliability dimension. Responsiveness questions include 8, 9, 13, 14, and 19. Empathy dimension questions include 12, 16, and 17. Tangibles dimension includes questions 1, 7, 15, and 18. Finally, questions 3, 4, 6, and 11 were grouped into the Assurance dimension.

1. The use of technology X made it easy to see the material presented.
2. **The use of technology X was inappropriate to this class.**
3. The use of technology X helped me learn the material presented.
4. **The use of technology X was a good way to reinforce assigned reading material.**
5. Technology X worked when it was supposed to.
6. **The use of technology X helped me pay attention in class.**
7. The use of technology X was distracting.
8. **The use of technology X helped make this course more interesting.**
9. The use of technology X allowed me to focus better on what the professor was saying.
10. **Using the technology X was more trouble than it was worth.**
11 The use of technology X made me more confident about what I was learning.
12. **The use of technology X helped me to better understand fundamental course concepts.**
13. The use of technology X tended to oversimplify lectures.
14. **The use of technology X helped me "keep up" with lecture.**
15. Technology X used in this class was visually appealing.

16. The use of technology X helped me organize my lecture notes.
17. The use of technology X helped me understand the lecture material.
18. **Technology X is a modern, up-to-date lecture method.**
19. I wish more of my instructors used technology X in their classes.

Each specific technology will require its own set of 19 questions. For example, the question set for Internet-based activities would read, (1) the use of Internet activities made it easy to see the material presented, (2) The use of Internet activities was inappropriate to this class, etc.

CONCLUSIONS/RECOMMENDATIONS/ FURTHER RESEARCH

This research proposes a battery of items designed to measure the quality of service delivered by various instructional technologies. The scale is designed to encompass the five dimensions of service quality conceptualized by Parasuraman, Zeithaml, and Berry. Once validated, this scale is designed to assist faculty in gauging the differential ability of instructional technology to improve the quality of classroom instruction. The researchers will test this instrument in MIS classrooms, as well as within other business disciplines.

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A PRELIMINARY STUDY OF STUDENT PERCEPTIONS OF THE INTERNET

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INTRODUCTION

The business environment is changing rapidly as it becomes more data-intensive with information technology becoming highly integrated into the business environment. Computer automation has been primarily a welcome innovation. Total automation has not been realized, and is likely not feasible. The Internet, a new technology now becoming widely used by students and professionals, is facilitating the availability of large quantities of rich information including text, graphics, sound, and video. The Internet provides access to on-line information faster and more accurately than ever before.

Automation operates across all areas of a business. Managers and professionals can access customer information, monitor production, track progress, research issues, and prepare and exchange documents from their microcomputer based workstations. Networking allows users simultaneous access to the same data base for improved service and coordination. The Internet provides for the exchange of inter-organizational information, including electronic data interchange (EDI), electronic mail (e-mail), and electronic commerce.

Despite the numerous potential benefits from using the Internet in a business environment, problems remain with implementing this advanced technology and with its acceptance by affected workers.

PRIOR RESEARCH

Early research focused on the study of attitudes toward computer technology. One of the earliest studies to concentrate on attitudes toward computers was done by Lee [1], an employee of IBM. Lee developed a 20 item attitude scale to measure attitudes and collected responses from a large sample of adult Americans. Although his study results were published in 1970, his data was gathered in the early 1960's. His findings indicated that the respondents held two independent attitudes towards computers: one attitude saw computers as instruments of man's purpose (useful in space exploration, industry, science, etc.), and the second viewed computers as relatively autonomous entities that could perform the function of human thinking. He concluded that there was limited acceptance of computers by the general public and pointed to the need for education.

Lee's [1] computer attitude survey was replicated by an Morrison [2], Australian researcher, twenty-five years later. Morrison's main objective was to assess the change in attitudes toward computers in the two decades since Lee's study and to evaluate the attitudes of Australian students, who comprised his sample. Morrison's study resulted in factors which were radically different from Lee's. Four items loaded on a factor which he labeled "negative" and four other items loaded on a more positive factor called "application." Morrison's study also resulted in eight items that comprised two factors, both labeled "awesome." The largest amount of variance was explained by the negative factor, which represented attitudes toward the unemploying and dehumanizing effects of computers, and fears about their ability and their power over people's lives. This was opposed to Lee's largest factor - the "Beneficial Tool of Man" [1]. Due to the sample being comprised of Australian students, the ability to generalize from this study is suspect.

Two more recent studies have investigated contemporary attitudes toward computers. Turnipseed and Burns [3, 4] found that technology is becoming more accepted and integrated into the workplace. Attitudes have become more favorable with the dominate factor being labeled "positive/helpful" for younger, more well educated workers. There remains concerns about the social and ethical use of computer technology.

Based upon prior research on the attitudes towards computers in general, this study seeks to determine the perception of users toward the Internet.

METHODOLOGY

This study examined the perceptions of future business professionals with respect to their beliefs about the Internet and computer technology.

Sample

Data was collected from business students at a regional university in the southeastern United States. Business students were used as surrogates for business professionals and to validate the methodology of the research.

A sample of 345 subjects was used for this study. The subject's demographics are given in Table 1. None of the student subjects had taken a university computer literacy course prior to administration of the survey instrument. The sample exceeds the commonly accepted criteria of 10 times the number of items in a factor analysis.

TABLE 1
RESPONDENT DEMOGRAPHICS

Sex

	Frequency	Percent
Male	186	53.9
Female	159	46.1
Total	345	100.0

Age

	Frequency	Percent
<18	12	3.5
18-25	322	93.3
26-40	9	2.6
41-55	2	.6
Total	345	100.0

Occupation

	Frequency	Percent
Manager	15	4.3
Worker	51	14.8
Student	270	78.3
Professional	4	1.2
Other	5	1.4
Total	345	100.0

Computer Knowledge/Experience

	Frequency	Percent
No knowledge/ experience	11	3.2
Some exposure	91	26.4
Reasonable knowledge	211	61.2
Very knowledgeable	32	9.3
Total	345	100.0

Internet knowledge

	Frequency	Percent
No knowledge/ experience	23	6.7
Some exposure	139	40.3
Reasonable knowledge	161	46.7
Very knowledgeable	21	6.1
Expert	1	.3
Total	345	100.0

Instrument

The survey instrument used in this study was modified version of an instrument designed by Lee [1], and used in research by Lee [1], Morrison [2], and by Turnipseed and Burns [3, 4]. The key distinction was the use of the term "Internet" was substituted for "computer" where appropriate (see Table 2). The respondents' agreement with each item was marked on a 5 point scale ranging from 1 (strongly agree) to 5 (strongly disagree).

TABLE 2
SURVEY QUESTIONS

1. There's something exciting and fascinating about the Internet.
2. The Internet is strange and frightening.
3. The Internet is so amazing that it staggers your imagination.
4. The Internet sort of makes you feel that computers can be smarter than people.
5. The Internet is very important to science and research.
6. The Internet can be used for evil purposes.

7. The Internet will bring about a better way of life for the average individual.

8. With computer technology, the individual will not count for very much anymore.

9. Computers think like human beings think.

10. Computers will free individuals to do more interesting and imaginative types of work.

11. The Internet is becoming necessary to the efficient operation of businesses.

12. Computer systems can make serious mistakes because they fail to take the human factor into account.

13. Someday in the future, the computer may be running our lives for us.

14. The user of the Internet increases business competitiveness.

15. There is no limit to what computers coupled with the Internet can do.

16. The Internet works at lightning speed.

17. Computer technology helps to create unemployment.

18. The Internet is extremely accurate and secure.

19. Computer systems can make important decisions better than people.

20. They are going too far with computer technology.

Data Analysis

Similar to analysis conducted by Lee [1], Morrison [2], and Turnipseed and Burns [3, 4], the responses were analyzed by factor analysis of the correlation matrix, using varimax rotation. Two analyses were conducted. First, two factors were extracted to provide a clear understanding of the dominate factors represented by the study. Second, to obtain a complete assessment of respondent attitudes, the data was factor analyzed with the number of factors extracted based upon the eigenvalues greater than unity in the principal component analysis.

RESULTS

The results of this study are presented in two parts: the restricted analysis limiting the number of factors to two, and a complete analysis not restricting the number of factors.

Two Factor Analysis

The results of factor analysis, with varimax rotation, and extracting two factors are provided in Table 3. Seven items failed to load (items 2, 6, 12, 15, 17, 19, and 20) when restricted to two factors. All other items loaded at a value of 0.40 or higher. These factors were labeled "Positive/Amazing" and "Negative/Threatening". Our study, with two factors, accounted for only 29% of the variance in the data.

n-Factor Analysis

Factor analysis provided six factors with eigenvalues greater then unity (1). Only one item failed to load (item 2). These factors were labeled "Positive/Beneficial", "Powerful Tool", "Negative/Evil", "Fascinating", "Humbling", and "Mistake Generator". Table 4 provides the loading for each factor. Nineteen (19) of twenty (20) items loaded with values greater than 0.40. These factors account for 55% of the variance in the data.

DISCUSSION

Two Factor Analysis

The two-factor analysis provides a clear indication that the dominant factor is positive. The participants felt that, overall, the Internet and computing technology was helpful and beneficial. Some items indicated amazement with the technology. This factor explained 17% of the variance.

The secondary factor was clearly negative. This factor suggests a fear and mistrust of the technology and its power. The concern that technology will be 'running our lives' and 'the individual person will not count for much anymore' are evidence that additional work is needed to alleviate the undercurrent of fear and mistrust. This factor explained 12% of the variance.

Implications for educators suggest that we continue to demystify the technology both the Internet and computing technology.

n-Factor Analysis

The n-factor analysis provided a more comprehensive evaluation of respondent opinions. However, the interpretation of results was more complex and ambiguous.

TABLE 3
TWO FACTOR ANALYSIS

Item	Positive/Amazing	Negative/Threatening
1. There is something exciting and fascinating about the Internet.	**.640**	-.196
2. The Internet is kind of strange and frightening.	-.333	.291
3. The Internet is so amazing, it staggers my imagination.	**.446**	.103
4. The Internet makes you feel like computers can be smarter than people.	.195	**.438**
5. The Internet is very important to research and space exploration.	**.541**	.092
6. The Internet can be used for evil purposes.	.119	-.139
7. The Internet will bring about a better way of life for the average individual.	**.603**	-.016
8. With computer technology, the individual will not count for very much anymore.	-.204	**.614**
9. Computers think like human beings think.	.085	**.702**
10. Computers will free individuals to do more interesting and imaginative types of work	**.582**	-.040
11. The Internet is becoming necessary to the efficient operation of businesses.	**.627**	-.033
12. Computer systems can make serious mistakes because they fail to take the human factor into account.	-.048	-.001
13. Someday in the future, the computer may be running our lives for us.	.200	**.547**
14. The user of the Internet increases business competitiveness.	**.589**	.051
15. There is no limit to what computers coupled with the Internet can do.	.434	.409
16. The Internet works at lightning speed.	**.457**	.192
17. Computer technology helps to create unemployment.	-.044	.269
18. The Internet is extremely accurate and secure.	.065	**.705**
19. Computer systems can make important decisions better than people.	.410	.012
20. They are going too far with computer technology.	-.403	.319

TABLE 4
N-FACTOR ANALYSIS

	Positive/ Beneficial	Powerful Tool	Negative/ Evil	Fascinating	Humbling	Mistake Generator
ITEM 1	.400	-.111	-.033	**.597**	-.090	.006
ITEM 2	-.390	.028	.319	.086	.371	.286
ITEM 3	-.056	.102	.023	**.803**	.218	-.086
ITEM 4	.121	.198	.020	.105	**.830**	-.062
ITEM 5	**.620**	.022	-.013	.158	.316	.297
ITEM 6	.088	-.280	**.468**	.337	-.249	.143
ITEM 7	**.585**	.130	-.257	.165	.051	.067
ITEM 8	-.132	.431	**.587**	-.126	-.045	.020
ITEM 9	-.039	**.777**	-.017	-.026	.184	.022
ITEM 10	.286	.090	-.170	**.523**	.030	-.125
ITEM 11	**.779**	-.052	.070	.045	.011	-.168
ITEM 12	.111	-.263	.404	.058	.134	**.461**
ITEM 13	.361	.376	**.471**	-.144	.080	-.165
ITEM 14	**.594**	.046	.223	.250	-.146	-.131

TABLE 4
(continued)

	Positive/ Beneficial	Powerful Tool	Negative/ Evil	Fascinating	Humbling	Mistake Generator
ITEM 15	.294	**.540**	-.024	.204	-.015	.041
ITEM 16	.233	**.479**	-.223	.352	-.226	.351
ITEM 17	.049	-.007	**.640**	.023	-.007	-.102
ITEM 18	-.066	**.758**	.094	-.017	.096	-.121
ITEM 19	.204	-.043	.119	.332	.092	**-.719**
ITEM 20	-.189	-.030	**.546**	-.254	.234	.126

The dominant factor, labeled 'Positive/Beneficial' was clearly positive. It was encouraging to have 4 items load to the first factor explaining 12.5% of the variance. The second factor, labeled 'Powerful Tool', was composed of 4 items, was positive and was very close to the first factor, explaining 11.4% of the variance. These two factors represent 23.9% of the total variability and overpower the other factors in the analysis

The third factor, labeled 'Negative/Evil' was composed of 5 items and was clearly negative. Explaining 9.9% of the variability, this factor suggest that there is still uneasiness with the use of the Internet and computing technology. Overcoming these concerns must be addressed in our curriculum and course design.

Factor 4, labeled 'Fascinating', indicates an attitude of wonder and amazement. Certainly not negative, more positive and genuinely intriguing. It indicates a need to explore and use a fascinating new tool. The factor explained 9.5% of the variance.

Factors 5 (labeled 'Humbling') and 6 (labeled 'Error Generator') explained less variance (6.2% and 5.9% respectively) than the other factors. Factor 5 was a single item factor suggesting that 'computers can be smarter than people'. Again, not overtly negative, this factor appears closer to Factor 4, 'Fascinating'. Factor 6 is an indicator of concern for computer generated errors. Clearly negative, it reveals a degree of mistrust and apprehension with technology that still exist in our academic environment.

An evaluation of all factors comprehensively suggests that four of the six were positive and only two suggest concerns. These concerns however are real and must be dealt with in our educational environment. Courses must be developed that reinforce the use of technology as a positive, beneficial tool. The concerns about technology threatening jobs, lives, and individual worth must be addressed. Only in understanding our constituents attitudes and perceptions can we adequately prepare to use technology effectively.

CONCLUSIONS

This study provided an understanding of the perception of business students on the Internet and computing technology. The dominant attitudes were positive. However, there was an element of concern that the technology would be used inappropriately. The Internet is rapidly becoming a tool used universally by business for the electronic exchange of critical information. Managers must learn how to effectively use this technology. A first step is an understanding of their perceptions and attitudes toward this new technology.

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TEACHING SPATIAL ANALYSIS IN BUSINESS: THE CASE OF GEOGRAPHIC INFORMATION SYSTEMS IN A DECISION SUPPORT SYSTEMS COURSE

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Geographic information systems (GIS) are increasing in importance as a resource for collecting, managing, and analyzing data pertaining to a variety of business problems. Yet, the number of business schools that have incorporated GIS as a significant part of even one of their core business courses is quite small. Thus, little is known about how to teach GIS in business courses and how business students respond to being taught about this subject. To examine these issues, GIS training was included as a significant part of a decision support systems course offered within a traditional business school curriculum. Attitudes and opinions of students concerning the role of GIS in business were collected both prior to and after students were given training on GIS in the course. Results indicate that students' attitudes about the effectiveness of GIS as a decision support tool and it role in business courses improved after their exposure to the technology. However, the results also showed that students did not develop more positive perceptions about the benefit of GIS training on their careers. The paper also discusses some of the instructors observations related to teaching GIS in business school courses.

INTRODUCTION

Geographic information systems (GIS) provide both database management and decision support capabilities that offer users a powerful set of tools for solving a variety of mission critical tasks and problems (Fung & Remsen, 1997; Mennecke, 1997; Wofford & Thrall, 1997). GIS have been successfully used for many years by decision makers in public planning and administration and in a variety of government agencies and bureaus (Brudney & Brown, 1992; Grupe, 1992; Worrall, 1994). Over the last few years GIS has also begun to be used extensively by business organizations in a variety of industries (Mennecke, Dangermond, Santoro, & Darling, 1998; Francica, 1998). Because many decisions include geographic concepts (e.g., the location of infrastructure, customers, labor, natural resources, or transportation assets), these systems can be particularly useful in helping to implement tactics and perform strategic planning.

There is little doubt that GIS is an important technology for business, but does this mean that it should be taught in business school courses? Unfortunately, the jury is still out regarding this question. For example, the traditional place where geographic concepts and techniques are taught is in geography departments. Yet many, if not most, geographers are ill equipped to teach business concepts and applications (Mennecke, 1997).

Where then does this leave us? Who should be teaching concepts related to GIS applications for business? This is a question that is being asked more frequently by academics and users alike. For example, a round table discussion on the issue of teaching GIS as a business tool was conducted recently at the Business Geographics for Educators and Researchers conference (June, 1997; Atlanta Georgia). Leading representatives from academia and industry participated. Although a variety of opinions were voiced, many participants agreed on two issues:

1. The principles of geography, cartography, and other technical mapping concepts should be taught by those who have the best understanding of these issues: Geographers.

2. However, because GIS is a tool that can be and is being used by business, there is an important role for business schools in teaching GIS in a number of areas.

In this context, GIS should be taught in like manner to the way that spreadsheet and database software is taught to business students: as a problem-solving tool. As such, students who are taught GIS should be taught those principles and concepts related to the technology that enables them to be intelligent users. This concept is similar to the way GIS is taught in many other disciplines such as political science, public planning, archeology, and geology. Students in these disciplines often take only one or, at most, two course covering GIS applications so that they learn enough about the technology to utilize it effectively and correctly.

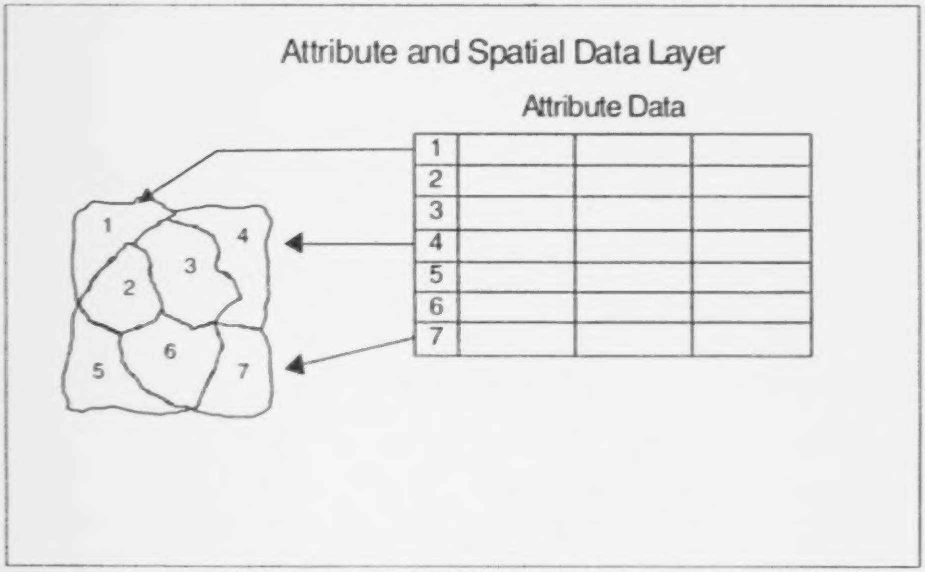
However, if GIS is to be taught to business students it is important to know how they will respond to this experience. Therefore the purpose of this paper is to examine student perceptions about the role of GIS in business school courses and the implications of these attitudes for teaching this topic. To examine this issue, we conducted a research study to identify student attitudes about the effectiveness of GIS, its potential impact on their career, and their opinion about the role of GIS in business school courses. The next section provides background information about GIS and GIS education. Next, the research methodology used to conduct this study is presented. Following this, the results are discussed. Finally, the paper concludes with a discussion of the findings and implications for education and future research.

BACKGROUND AND LITERATURE REVIEW

What Is GIS?

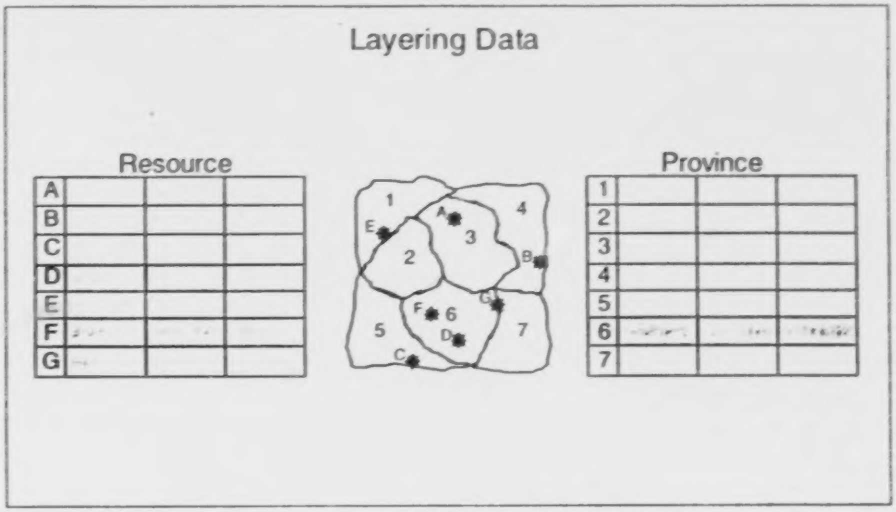
GIS are a type of relational database management system that can be used to store attribute data about entities as well as information about the spatial location of features associated with table entries. Figure 1 illustrates how each table entry (shown on the right) is linked to a feature on the map. The spatial data is stored by recording both the coordinates of the spatial features as well as data that identifies the features. The unique capability of GIS software relates to the ability of the GIS database engine to integrate the spatial and attribute data. For example, if a GIS layer has a field for county name and an attribute table in another database also has a field for county name, a join can be constructed between the two data sets. As a result, GIS data can easily be integrated with data derived from other database environments. This means that users are enabled to integrate GIS functionality with data that reside in other organizational information systems.

FIGURE 1
THE RELATIONSHIP BETWEEN ATTRIBUTE AND SPATIAL DATA FOR A SPATIAL DATA LAYER (I. E., SPATIAL COVERAGE)



One of the most powerful capabilities of GIS is their ability to display the spatial location of records on a map thus enabling the user to visualize the relationship between objects of interest. This visualization capability is important because many business problems require that decisions pertaining to the relative location of features be ascertained. For example, Figure 2 illustrates how the GIS can be used to bring together and display resource locations D, F, and G and show that they are located within the boundaries of Province 6. Further, the GIS database engine is able to create a join between the attribute (tabular) data for the corresponding tables. It is therefore possible to create a query based on the spatial proximity of objects, the characteristics of the objects, or a combination of these criteria. A GIS' ability to create spatial joins gives these systems the same capabilities for summarizing and exploring data that conventional database management systems (DBMS) have except that geography serves as the primary key for linking different tables.

FIGURE 2
A JOIN BETWEEN TWO DATA SETS SHOWING THE SPATIAL RELATIONSHIP OF FEATURES



GIS Pedagogy: The View from Across Campus

Much can be learned about teaching GIS in the business school by reviewing the courses and programs in GIS that are taught in various units across a typical university campus. As noted above, geography departments are the traditional and logical home for teaching GIS. In addition, there are also a number of departments such as forestry, geology, archeology, and public planning that teach GIS in one or more courses that are core to each discipline. To understand what is typically taught in these courses, we will briefly review the courses content for two of these disciplines.

GIS in the Department of Geography

Geography programs are as diverse as business schools. Nevertheless, just as business schools have guidelines for curriculum content (e.g., those promulgated by the American Association of Collegiate Schools of Business, AACSB), so too do geography departments. The National Center for Geographic Information and Analysis (NCGIA) has proposed a model core curriculum for GIS education (see Goodchild & Kemp, 1992; http://www.ncgia.org). The model curriculum consists of more than 100 one-hour units (see Table 1). As can be seen by examining their curriculum the content represents a comprehensive list of issues that are relevant to designing, implementing, managing, and using a GIS. Further, although the curriculum includes content related to GIS applications, the bulk of the curriculum focuses primarily on technical issues related to GIS. Thus, a student seeking to become a GIS professional who is an expert in most facets of the design and use of the technology should enter a quality geography program offering this curriculum.

Of course, this does not mean that all students seeking to use GIS need to complete all of the segments of the

NCGIA core curriculum. As noted earlier, many academic departments include GIS content for their students. Much can be learned about how to integrate GIS into business courses by examining these academic units. Public planning departments have been incorporating GIS into their curriculum for a number of years, therefore it is useful to examine how they have successfully integrated this technology.

TABLE 1
NCGIA CORE CURRICULUM CONTENT TOPIC AREAS

0. GIS Awareness

1. Fundamental Geographic Concepts for GIScience
    - 1.1. The world in spatial terms
    - 1.2. Representing the earth
    - 1.3. Position on the earth
    - 1.4. Mapping the earth
    - 1.5. Spatial relationships
    - 1.6. Abstraction and incompleteness

2. Implementing Geographic Concepts in GISystems
    - 2.1. Defining characteristics of computing technology
    - 2.2. Fundamentals of computing systems
    - 2.3. Fundamentals of information science
    - 2.4. Representing fields
    - 2.5. Representing discrete objects
    - 2.6. Representing networks
    - 2.7. Representing time and storing temporal data

3. Geographic Information Technology in Society
    - 3.1. Making it work
    - 3.2. Supplying the data
    - 3.3. The social context
    - 3.4. The industry
    - 3.5. Teaching GIS

4. Application Areas and Case Studies
    - 4.1. resource management (162)
    - 4.2. urban planning and management (163)
    - 4.3. cadastral records and LIS (164)
    - 4.4. facilities management (165)
    - 4.5. network applications (166)
    - 4.6. environmental health (169)
    - 4.7. environmental modeling (170)
    - 4.8. emergency management (172)
    - 4.9. studying and learning geography (173)
    - 4.10. business and marketing (174)
    - 4.11. recreation (176)

GIS in the Department of Public Planning[1]

Public planning programs focus on teaching principles related to city, regional, and environmental planning and development. In many respects, the skills needed by public planners are similar to those needed by business school graduates. For example, many public planning graduates are employed by city, county, and state governments to function as managers and administrators. In this role they work within large organizations and often have supervisory or administrative responsibilities comparable to those that a business school graduate would have. Therefore planners generally need to develop skills in management, problem analysis, collaboration, decision making, computer applications, business, and economics.

How do planning departments typically integrate GIS into the curriculum? The answer is that it is similar to the way that Excel, SAS, or Access is integrated into a business school course. For example, many planning departments have one or two courses that focus exclusively on the topic of GIS and its application to the planning discipline. The content of these courses is typically quite technical, resembling the core curriculum proposed by the NCGIA. More commonly, however, GIS is integrated into extant courses such as regional planning and economics, quantitative analysis in planning, land use planning, environmental planning, or urban planning. In these courses, GIS is used as a tool to facilitate learning or to aid in the decision making or visualization process. Thus, GIS is used in a part of a course as a tool to illustrate concepts, learn new skills, or develop new insights about issues presented in the class. In this context, GIS is not the primary focus of the course, it is a means to an end. Since this is how GIS is most frequently used in business -- as a tool to help solve a problem, make a decision, or identify relationships that are not otherwise obvious -- this is how GIS should be taught in business courses.

GIS in the School of Business

What conclusions can we draw from how GIS is taught in these other disciplines? First, in most business schools there is little or no room in the curriculum for the highly technical GIS-as-a-specialty curriculum proposed by the NCGIA. Schools, which seek to obtain or maintain accreditation from organizations like the AACSB, must follow curriculum guidelines proposed by these accrediting organizations. At present, the AACSB has not promulgated guidelines that include much room for specialty courses in GIS or related technologies.

Therefore the most logical place to teach GIS in business school is in extant business school courses. In other words, business school faculty seeking to teach GIS should follow the example presented by other academic programs that have integrated GIS into their existing courses. Business courses such as marketing analysis and research, distribution and retail management, international business, introduction to computers, management information systems, decision support systems, decision analysis and problem solving, and real estate management all could benefit from the use of GIS as a teaching, analysis, and support tool. For example, GIS can easily and economically be integrated into a sophomore- or junior-level introductory computer course by using the Microsoft Excel DataMapÔ tool. DataMapÔ provides users with the ability to create maps that show the spatial distribution of data stored in an Excel spreadsheet. The DataMapÔ tool was designed to be easy to use yet provide powerful analysis capabilities (Mennecke et al., 1998).

It is in this context that this research was conducted. We integrated GIS into an existing decision support systems (DSS) course. GIS was presented to students as an example of a tool that offered data base management, decision analysis, and decision support capabilities in one software platform. In addition, other DSS topics and software such as data warehousing, group support systems, and expert systems were introduced to students in the course. Thus, GIS was presented to students as only one part of a course on the topic of decision support systems and it was presented to illustrate concepts relevant to the course.

The focus of our research is to understand how business students react to exposure to GIS technology. We focused on five areas:

1. Student perceptions of GIS effectiveness,
2. Student attitudes about the role of GIS in business courses,
3. Student attitudes about the effectiveness of GIS in helping them to understand business concepts,
4. Perceptions of the amount of understanding students had of GIS concepts, and
5. Perceptions about the impact of GIS education on helping students in their careers.

We are aware of no research that has examined these issues in a business course. Therefore, this research is exploratory in nature. However, we can form several expectations based on research in other areas. For example, prior research examining decision making shows that decision makers using GIS are more efficient and produce higher quality solutions than decision makers using paper maps (Crossland, Perkins, & Wynne, 1995). Therefore, we predict that after using GIS to complete various exercises during the semester, student perceptions related to GIS effectiveness and its role in helping them learn will be higher compared to their perceptions at the start of the semester. Furthermore, this should have a positive impact on student attitudes about the role of GIS in business courses. Unfortunately, we can make no theoretically supported predictions about students' understanding of GIS and business concepts and about GIS' impacts on careers.

RESEARCH METHOD

Student Subjects

The DSS course in which the research was conducted is a core requirement for management information systems (MIS) majors in the School of Business at East Carolina University. Students in the course were all at the junior- or senior-level and all students were majors in MIS. As such, they were familiar with a variety of software packages and programming languages. Two sections of the course were offered and examined in this research. All participants responded to a questionnaire administered by the course instructor. Participation in the survey was voluntary.

Course Content

In addition to GIS, the course covered a variety of DSS topics such as data warehousing, group support systems, and expert systems.[ii] In total, students were required to complete three GIS exercises or projects. The ArcViewÔ GIS software package, a product of ESRI, Inc., was used in this course.[iii] Two of the projects were small in scope while the third exercise represented a significant part of the course content. In total 7 class periods (75 minutes each) were devoted to presenting information about GIS.

Research Instrument"

Part of the research instrument was administered at the beginning of the semester as a pretest before students were exposed to any content related to GIS. The pretest questions plus additional questions about the students experiences in the course were also administered to students on the last day of classes as a posttest. Thus, the research represents a one-group, pre-test, post-test design (Campbell & Stanley, 1963).

RESULTS

The descriptive statistics for the results of the study are shown in Table 2. In summary, 55 students were enrolled in two sections of the DSS course. Of this, 51 surveys were completed by students at the beginning of the semester (the pretest) and 51 were completed at the end of the semester (the posttest). Unfortunately, only 45 students completed both the pretest and posttest questionnaire. The average age of the students was 24.35 years (std dev. = 4.95), they had an average of 2.54 years of work experience (std dev. = 4.93), the average GPA was 3.0 (std dev. = 0.35), and 30% of the responders were female. All students were MIS majors. As a manipulation check we asked students to rate their experience with GIS at the beginning of the semester and at the end of the semester. The results show that students reported having significantly more experience with GIS after the course was completed (t=-10.317; p<0.001).

To examine the research questions, a paired t-test was used since participants completed the questionnaire twice. For all but one of the research questions, the results show that students had significantly more positive perceptions of GIS after their training than prior to the training. For example, GIS was thought to be significantly more effective as a decision support tool (t=4.408; p<0.001), it was more likely to be perceived to have a role in business classes (t=-2.230; p=0.031), perceptions about its role in helping students understand business concepts improved (t=2.548; p=0.014), and students had more confidence about their skills related to working with spatial data and GIS (t=-11.722; p<0.001). However, the results also show that students' perceptions about GIS' influence on their careers opportunities did not improve (t=0.976; p<0.334).

In addition to these questions, we also asked general questions about the quality of the teaching, the impact of GIS on learning, whether more time should be spent on GIS, and their overall satisfaction with being taught GIS in the course. The results suggest that students held generally favorable perceptions about GIS when the course was completed. These results are discussed in more detail in the next section.

TABLE 2
MEANS, STANDARD DEVIATION, AND PAIRED T-TEST FOR DEPENDENT MEASURES

Measure[1]	Means and Statistical Parameters				
	N	Pretest (mean/std dev)	Posttest (mean/std dev)	Paired Sample t Statistic	P value
Perceptions of GIS effectiveness	45	2.53 (0.92)	1.80 (0.73)	4.408	<0.001***
Role of GIS in business courses	45	2.20 (1.06)	1.78 (0.85)	-2.230	0.031*
Role of GIS in understanding business concepts	45	2.51 (1.06)	2.11 (0.68)	2.548	0.014*
Student understanding of GIS concepts[2]	45	5.11 (1.78)	2.40 (0.72)	-11.722	<0.001***
GIS impact on a business career	46	2.61 (1.34)	2.80 (1.22)	0.976	0.334
Experience using GIS	46	6.13 (0.98)	3.85 (1.49)	-10.317	<0.001***
GIS use influenced learning	51		2.35 (1.02)		
Should more or less time be spent on GIS	51		2.92 (1.41)		
Instructor provided adequate instruction on GIS	51		2.04 (1.00)		
I am satisfied with my knowledge of GIS	51		2.18 (1.13)		

Table 2
(continued)

[1] All measures range from 1 (positive anchor) to 7 (negative anchor).

[2] This measure is the average score for the composite of three measures; " How do you feel about your ability to work with spatial data," " Rate your knowledge of geographic and cartographic principles," and " How do you feel about your ability to read and interpret tables, maps, and graphs?" The reliability coefficient for this measure is a=0.69.

DISCUSSION AND CONCLUSIONS

Our research study set out to examine the impact of teaching GIS on student perceptions about the technology. GIS is a technology that most students were expected to have little or no experience with prior to the semester. The pretest measure of student experience with the technology substantiates this expectation. This, combined with the common perception by most business people (i.e., students, faculty, and practitioners) that GIS is a tool for geographers, suggests that it is worthwhile to empirically examine the reaction of business students to this novel technology. In general, our results suggest that students developed more positive perceptions about GIS after sustained use of the technology over time.

The only exception to this is that our results also showed that students' perceptions about the impact of GIS on their careers did not improve significantly during the semester. These results were somewhat surprising given the other findings. There are several reasons why this might have happened. First of all, students held a relatively high perception about GIS' potential impact on their careers early in the semester (M=2.61). This fact, by itself, is also somewhat surprising. Since the initial instrument was administered very early in the semester before GIS had been discussed, it seems unlikely that the instructor would have had the opportunity to bias the results considerably. It is possible that the very inclusion of the topic in the course might have influenced student perceptions about its importance for their careers. It is also worth noting that the mean for this variable at the end of the semester showed a (non-significant) negative shift (M=2.80). The lack of positive outcomes associated with this variable may also have been influenced by an event that occurred during the semester. Specifically, a job fair was held approximately three weeks prior to the end of the semester. Since many of the students in this course were seniors approaching graduation, they attended the job fair and spent considerable time discussing employment opportunities with recruiters. Several students reported to the instructor their surprise that many recruiters were unaware of GIS and did not consider it important in their hiring decisions.[v] Such an event would likely have a strong negative impact on student attitudes about this issue.

Given these findings, if student perceptions about a technology have anything to do with selection of course content, then GIS appears to be a suitable technology for use in business courses. Of course this is not the only criterion for selecting course content and technological tools for inclusion in business courses. Factors such as curriculum guidelines, the relevance of the tool to employer needs and requirements, the relevance of the tool to the content and purpose of the course, and other considerations are all important. Unfortunately, because data that would address some of these factors have not yet been collected, a full assessment of the role of GIS in business courses is currently beyond our grasp. Thus, further research about the role of GIS in business is needed.

While the jury remains "out" on some of these questions, this does not imply that there is currently no reason to incorporate GIS into business courses. Regardless of what future research demonstrates about the importance of GIS in business, it is doubtful that GIS software will in the near term become as highly integrated into business courses as have statistics, database, and spreadsheet software. Nevertheless, there are good reasons to selectively and, in some cases, marginally incorporate GIS into a variety of business courses. For example, our results suggest that business students can develop positive perceptions about GIS through exposure to the technology. This should ultimately have a positive impact on learning. But these outcomes are likely moderated by the relevance of the technology to the course content and to students' likelihood to benefit from their exposure to the technology. In the case of the DSS course in which we incorporated GIS, the technology was likely perceived by students to be highly relevant because it was presented to them as a useful tool for illustrating DSS concepts. GIS would likely have little or no relevance to, for example, many finance and accounting classes, therefore it would undoubtedly not be received favorably by students. In other courses such as, for example, retail management the visualization capabilities of GIS combined with its ability to integrate multiple data sources (e.g., information about the location of current and potential future customers), would make it very relevant and useful for illustrating concepts and ideas related to siting a new retail store. Thus, GIS is something that has the potential to improve business education if it is applied to courses thoughtfully.

An interpretation of the findings of this research is limited by the methods used and the context of the study. For example, the students in the course investigated in this research were MIS majors. Such students should be more likely to accept and appreciate new and innovative technologies than would students from other majors. For example, since MIS majors have extensive experience with a variety of software packages, their ability to learn new software would likely be superior to that of students from other majors. Many GIS packages can be quite difficult to learn when they are first used. Students possessing fewer skills and less experience with information technologies might encounter greater difficulties learning and using this type of software. This would undoubtedly lower their rating of the software. This suggests that future research should examine student populations from other majors such as marketing, management, and production. Similarly, the ArcViewÔ GIS package was used in this study. This software is one of several GIS products. Results may differ if other GIS packages were used in the course. Finally, the researcher conducting this study was also the instructor of the DSS course. Although the instructor attempted to hide the purpose of the research and to suppress highly biased comments, there is always the possibility that the instructor's interest in the topic of GIS might have influenced the results or lead to response biases. Future research replicating this line of inquiry would help to remove such concerns.

ACKNOWLEDGMENT

This research was partially supported through a software grant from ESRI, Inc.

ENDNOTES

[i] See http://www.netins.net/showcase/pab_fi66/applica.htm for information about curriculum in the public planning discipline.

[ii] An outline of the course content as presented to students in the syllabi is available from the author.

[iii] ESRI supported this research by donating licenses for the ArcViewÔ software to the instructor.

[iv] The research instrument is available from the author upon request.

[v] This is not surprising since GIS is often a "back-office" technology. In other words, it is something that is often used in one or two units in an organization and may not be widely known about in other area. Nevertheless, many well known medium and large sized employers such as Levi Strauss & Company, Sears, McDonalds, and American Isuzu Motors use GIS for a number of applications (Mennecke et al., 1998).

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ELECTRONIC TEAMS AND PROGRAMMING: THE C++ EXPERIENCE

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There has been a movement towards teamwork in education. Moreover, with technological advancements electronic team experiences are more and more apparent. This methodology provides students for a needed background for the business world. However, many programming courses are still taught without a team framework. Another deficiency is the user is not first and foremost in mind for many exercises as new programmers are bogged down in syntax. These deficiencies were addressed in a first programming course in C++.

Students were placed in teams in C++ class and teamed with students from an Intro to MIS course. The programming students did not only write programs but used FTP to send them to their less computer literate teammates, provide directions on installation, and provide feedback on user friendliness. This was all accomplished in a semester using electronic teams with students from the same university. The presentation will provide complete details. Further details can be obtained by e-mailing me at sdjessie@mama.indstate.edu.

THE NEED TO INTEGRATE MIS WITH ELEMENTARY EDUCATION

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Dennis Bialaszewski
Indiana State University

The Information Age is upon us and yet some elementary school systems are not prepared for it nor preparing their students for it. As University Curriculum is structured for elementary school educators too often computer literacy often taught by computer science departments is required rather than information literacy usually taught by MIS departments. Rather than a focus on languages and hardware there is a need for systems development with a focus on managing technology. This mistake will prolong issues that need to be addressed today by our elementary school educators and administrators.

In the final presentation we will discuss issues such as a need for appropriate training and continuing education for educators ... what plans are designed by principals and districts to keep instructors aware of technological changes and improvements in information access. Is what is being promoted being done so in a systematic manner? Is it consistent across schools? If there are problems with a PC in the classroom what systematic plan has been designed ... is maintenance contracted out or is a specialist hired internally ... and what thoughts have been given to reduce the maintenance issue with ever changing software and upgrades? Has "thin client computing" been discussed as an option? Is there a desire to have all systems internal to a school compatible and also compatible with the district ... and have the pros and cons of doing so been discussed ... If an outdated version of software is being used who has the decision to upgrade and how is the decision implemented? Does the school principal make these decisions or are they made by advice from an IS professional ... and just contracting something out does not mean the process can then be ignored it still must be watched carefully ... who would have the responsibility for the overseeing?

The above questions and answers may also shed light as to just how high of a priority the school district has placed on keeping abreast of the Information Age ... Now students can search using software like Netscape for maps of countries and pictures of things discussed in class. There is a movement to active learning ... how is this being approached in the various school districts? If future elementary school teachers are not being exposed to the appropriate curriculum the best answers will not be attained! What is the degree of communication between elementary school educators and MIS educators at the university level? Indiana State has an MIS advisory board consisting of leaders in MIS and we are now discussing adding leaders in education to this advisory board. This input is necessary if the classroom of the future is to be designed sot hat students can work in teams and integrate information as it is available.

No less important are the administrative issues even including student performance ... now it is easy for teachers to electronically fill out forms and attach them to all needed parties ... are schools attempting to reduce paperwork ... and ... who in each school has been trained in systems analysis to either build or comment on the future system? Will systems be re-engineered ... that is will we look at what is available and try to build the best system or will we bogged down spending too much time making moderate changes to existing systems?

In conclusion, the object of this presentation will be to promote dialog of educators at an international level as food for thought in curriculum development and for the need for MIS educators and schools of education to communicate so the proper education is provided for future teachers as well as providing the appropriate continuing education for those involved in elementary education.

INTEGRATING THE INTERNET INTO COURSE DELIVERY: PAST, PRESENT, AND FUTURE

Organized by
Dennis Bialaszewski
Indiana State University

Panelists
Janice M. Burn
Edith Cowan University

Geoffrey Dick
University of New South Wales

Tom Pencek
Merideth College

Many institutions are integrating the Internet into course delivery. Some use e-mail to communicate with students while others are able to deliver complete courses over the Internet. Technology has allowed us to approach distance education quite differently than in the not too distant past. In this panel, we will comment on where their respective institutions started integrating the Internet into course work, where they are currently, and what they believe the future to be. Moreover, they will comment on where they currently are with "distance education" and what they believe the future to hold. The panelists have diverse backgrounds and institutional environments. Their comments should provide direction for others while at the same time helping them to avoid pitfalls.

INTERNATIONAL QUALITY STANDARDS SYSTEMS IMPLEMENTATION OF ISO 9000 BY REGIONAL BUSINESS

Stephanie Huneycutt
Christopher Newport University

Kathryn McCubbin
Christopher Newport University

The ISO 9000 series of International Standards for quality management and quality assurance is a voluntary benchmark of quality for international as well as regional businesses. It is adopted in over 90 countries and represents the apex of consistency and conformity to high standards for businesses, their suppliers and clients. The objective of this study and survey si to investigate regional business perceptions of an international management system, the ISO 9000 standards certification process. A population of manufacturing businesses located in the mid-Atlantic region was selected for preliminary investigation; these were obtained using Internet search engines. Survey instrument is a simple questionnaire, intended to identify costs, benefits, risks, and perceptions relating to internal management and external quality of firms who considered implementing ISO 9000 quality standards. A small sample, open-ended questions, and generality are weaknesses in the survey instrument; however, the survey results confirm business perceptions of the value, costs, benefits and burdens of the ISO 9000 standards and the third party registration process. The results of the survey instrument may be helpful to businesses faced with a decision to implement ISO 9000 standards; it provides basic preliminary, empirical and anecdotal information. Follow-up studies, focus groups and data collection are currently underway and are expected to contribute to the decision making capability of businesses contemplating initial ISO 9000 standards implementation and those businesses re-affirming the ISO 9000 standards.

INTRODUCTION

Literature on the topic of ISO 9000 standards implementation cites the following motives for implementation of ISO 9000 standards in businesses: improved product quality, world-class recognition, customer requirements, cost reductions and improved internal operations [1]. These motives, which in fact are expectations of benefits derived from ISO 9000 standards implementation, are virtually untested perceptions. Businesses themselves are not required to have measured the resultant benefits derived from ISO 9000 standards implementation. More studies are needed to test the perception that implementation of the ISO 9000 standards produces or is related to improved product quality and cost reduction, and improved internal operations and improved internal management. Without such empirical data, many businesses decide whether or not to adopt the ISO 9000 standards and subsequent methodology of quality management without quantifiable evidence.

HYPOTHESES AND METHODOLOGY

The following hypotheses were tested. Each pertains to a firm's business decision to implement the ISO 9000 standards and attempt to quality for verifiable third party ISO 9000 standards certification.

- [ISO 9000 Standards] Certification Improves Internal Management in the Firm
- [ISO 9000 standards] Certification Increases Gross Revenue in the Firm
- [ISO 9000 standards] Certification Identifies Problems Areas in the Firm

A survey questionnaire was designed to elicit demographic data and test these hypotheses for both "certified" and "non-certified" manufacturing firms. The ISO 9000 series of standards was selected; no inquiry regarding the ISO 14000 series of standards was attempted. The survey was limited to manufacturing companies located in the mid-Atlantic region of Hampton Roads area of Virginia, USA, an area developing its potential in international commerce and where the authors serve as full-time faculty in a Virginia state university.

A search for suitable businesses to respond to the survey was conducted and yielded a group of regional companies who were certified to ISO 9000 standards and regional companies who were not so certified. Demographic data requiring the identification of the firm's years in business, gross annual revenue, number of employees, manufacturers product SIC code was included on the questionnaire. It also required completion of a series of rated answers regarding the company's own perception of the advantages and disadvantages of implementing ISO 9000 standards. The surveys were mailed to 121 non-certified companies and 53 ISO 9000 certified companies. Responses by 35 non-certified firms and 18 ISO 9000 certified firms comprise the respondent sample.

SURVEY RESULTS

- "ISO 9000 Standards Certification Improves Internal Management"

  Certified companies and non-certified companies both viewed ISO Certification as beneficial to internal management. In the "Strongly Agree" response, 25% of non-certified companies and 38% of certified companies stated that ISO certification improves internal management. In the secondary "Strongly Agree" response, 33% of non-certified companies and 55% of certified companies stated the ISO Certification Improves Internal Management. The neutral response received support from 30% of non-certified companies, but no certified companies were neutral about the ISO Certification Improves Internal Management survey question. However, 6% of the certified respondents strongly disagreed that ISO Certification Improves Internal Management. The response to this perception of improved internal management by both non-certified and certified companies is that ISO Certification Improves Internal Management.

- "ISO 9000 Certification Increases Gross Revenue"

  No certified companies strongly agreed that ISO Certification Increases Gross Revenue while some non-certified companies did so respond (10% of non-certified companies strongly agreed and no certified company strongly agreed that there was any correlation between ISO Certification and Increased Revenues.) Responses indicated that 3% of non-certified companies and 30% of certified companies agreed that ISO Certification was positively related to Increased Gross Revenue. In the neutral response category, 60% of non-certified companies and 46% of certified companies saw no relation between ISO Certification and Increased Gross Revenue. Twelve percent of non-certified companies and 21% of certified companies disagree that there is a correlation. Nine percent of non-certified companies strongly disagreed that ISO Certification Increases Gross Revenue, but none of the ISO Certified companies shared this perception. Most respondents, both certified and non-certified, were neutral on the issue of ISO Certification Increases Gross Revenue.

- "Certification Identifies Problem Areas"

  Respondents from non-certified companies were far less likely than their certified counterparts to state that ISO Certification Identifies Problem Areas (20% of non-certified respondents agreed while 55% of certified respondents strongly agreed). Forty percent of non-certified companies and 30% of certified companies agreed that ISO Certification Identifies Problem Areas. Thirty percent of non-certified companies and non of the certified companies were neutral. Fifteen percent of certified companies disagreed that ISO Certification Identifies Problem Areas. This is consistent with other studies' identification of motive factors [2].

ANECDOTAL DATA

Survey respondents were given an opportunity to comment on their perception of the ISO certification process. Many comments indicate the companies perceived great benefits from the ISO certification process as well as many pitfalls, high costs, complex reorganizations, and especially difficulties with sufficient documentation to meet the standards of the audit performed by the external ISO registrar. Most benefits identified included improved information systems management and a positive correlation to increased gross income.

CONCLUSION

The field is open for additional research and data collection of evidence relating to the implementation of international quality standards and the impact upon information management, quality management, and the ISO 9000 standards. Businesses need this information and analysis of the evidence to make informed decisions about adopting information management systems modeled upon the ISO 9000 standards.

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SAVA: COMMITTED TO ORGANIZATIONAL LEARNING

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Organizational learning is essential to Eastern and Central European companies which are transforming from command economies to free market economies. This case study demonstrates the use of computer-based information systems to enhance organizational learning.

INTRODUCTION

Stata (1989) suggests that U.S. companies can be rejuvenated by organizational learning; in fact, he claims that the only sustainable competitive edge arises from the rate of learning of individuals and organizations. The importance of organizational learning is not limited to companies located in Western industrialized countries. This article investigates how Sava, a Slovenian rubber company, restructured and evolved into a learning organization. This article focuses on the role played by computer-based communication in expediting Sava's organizational learning.

Organizational learning implies that information acquisition focus on both internal and external considerations (Figure 1). Internally focused information includes a company's vision, interaction with employees, dedication to learning, and commitment to organizational change and transformation (Table 1). Externally focused information includes a firm's interactions with customers, suppliers, shareholders, partners, competitors, labor market, and educational institutions (Table 1). Thus learning organizations must put in place information systems which enable scanning of the internal and external environments. After acquisition these two information streams are captured and processed by information systems and stored in data bases. Next, they are interpreted, systematized, and codified into organizational practices and procedures which form the basis of organizational learning. The lessons learned then motivate further environmental scanning for new information through a feedback loop.

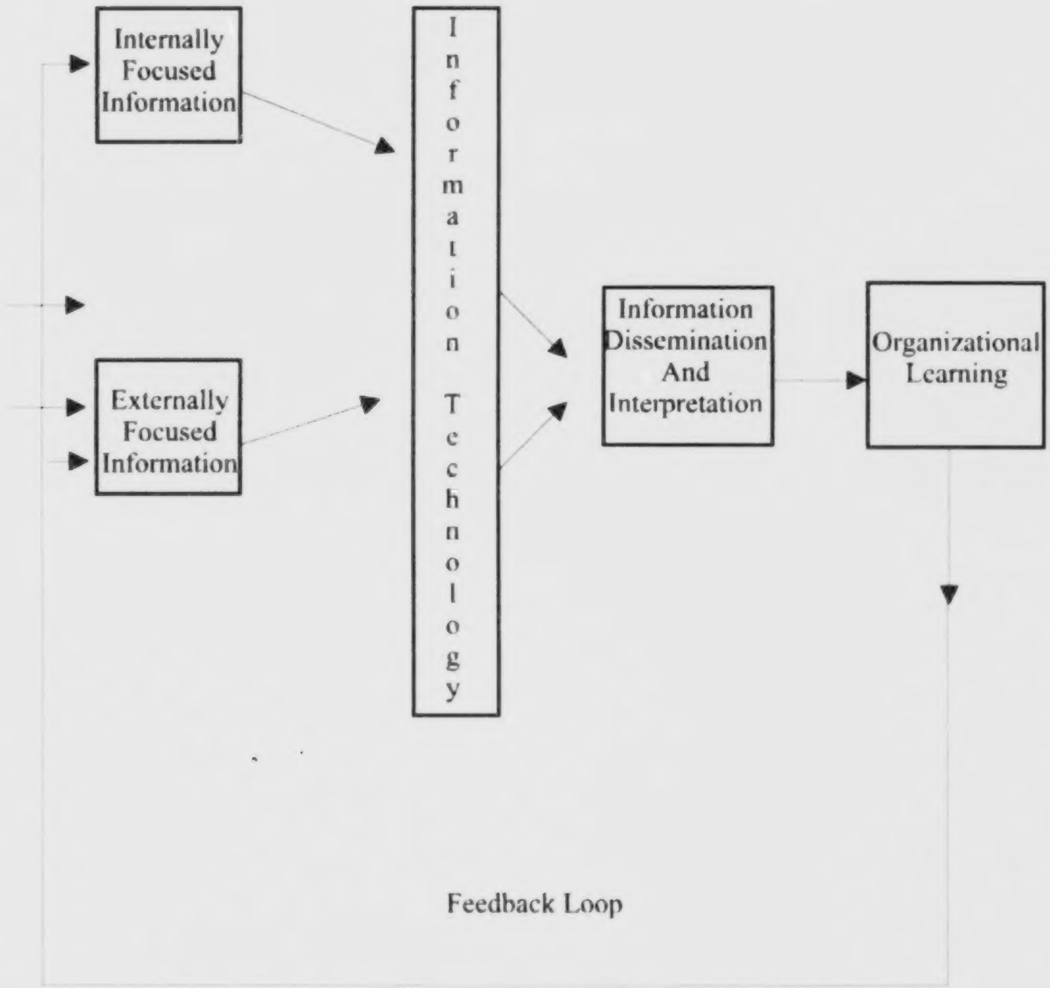
ORGANIZATIONAL LEARNING AT THE SAVA COMPANY

Sava is a large manufacturer of rubber products located in the City of Kranj, Slovenia. Car tires are Sava's most important products comprising 75% of the company's annual sales. The company's top managers realized that meeting the free market challenges is possible only with the full commitment of the employees. During our interview Mr. Bohoric, President of the company's Board of Directors (Bohorich, 1997) stated: "As we change [company] processes, programs, and products ...we also

TABLE 1
INTERNALLY AND EXTERNALLY FOCUSED EVENTS

Internal Events	External Events
Company Vision "...vision is to (1) satisfy our customer, (2) workers, (3) stockholders, and (4) respect the environment.:	Alliances "We decided to shop around for a new joint venture partner."
Employees "...[Employees] are responsibility for company success and failure...assume responsibility for personal, departmental, and organizational development... assume responsibility for the quality of work, the team's work, and the company's work."	Customers "...promising opportunities for manufacturing rubber transmission components, conveyor belts, and components for building and automotive components."
Learning "Stimulating employee innovations is a most important responsibility... Systematically encourage people to engage in learning processes... Every employee has to complete a set number of hours on educational activities."	Suppliers "...parts purchasing, bill of materials preparation, warehousing, and distribution. [Our] electronic data interchange system will integrate these operation."
Communication "[The new] e-mail system will profoundly affect communication... Employees will be better informed [and] this will act as a stimulus to seek additional information... There is a definite relation between IT and more effective communication."	Rubber Market "...[scan market for products such as] rubber blankets for environmental spills, rubber parts for building, mining, pharmaceutical, and electrical industries."
	Educational Institutions "...middle and top level managers are required to spend fifteen hours per year on education which can be satisfied by taking classes offered by outside educational institutions."
	Competitors "[We] practice benchmarking. [We have] information about the rubber industry. This is important because one should not go into [market] areas where one does not have competence."

FIGURE 1
ORGANIZATIONAL LEARNING


Internally Focused Information
Externally Focused Information
Information Technology
Information Dissemination And Interpretation
Organizational Learning
Feedback Loop

change the company's culture and the nature of work...[Thus] we are developing new and innovative ways for active worker participation and this [we believe] will help [the company] realize its goals."

Concerning employee learning, the Director of Human Resources stressed that the courses are taught by her department and that these emphasize organizational culture, general and interpersonal communication skills, team work skills, and managerial skills. Individual learning is central to the concept of organizational learning and the above illustrates that it is taken seriously by the company's top management (Table 1, Learning). In fact, the President of the Board of Directors stated (Bohoric, 1997):"Stimulating [employee] innovation is one of our most important responsibilities. I think that---delegation of responsibility itself helps develop creativity and stimulates people to be innovative. We systematically [encourage] people to be involved in different learning processes. Each Sava employee has to complete a certain number of hours per year of educational activities."

A different form of organizational learning inspired by external events arises from the company's relations with its customers and competitors (Table 1, Customers and Competitors). In the words of the President: "...many of our products are raw materials for other companies...Our engineers are in [continuous] contact with [the customer]...We invite the customer to share ...participate in the creation [and] development of our products...we have many meetings [with customers]...Organized by region [and] sometimes by product."

Concerning competitors the President (Bohorich, 1997) stated:"...The most important element of [organizational] learning is in our benchmarking [program]...We do our best to [find out] what others [i.e., our competitors] are making. Our competitors run fast...We have to measure...[Then] we run with them...If possible run faster...We now [can get] this information because of our joint ventures with other companies."

The President expanded on the organizational learning just discussed by stating that the information arising from alliances such as joint ventures with other rubber companies enables the Sava Company to successfully restructure its operations (Table 1, Alliances).

ORGANIZATION LEARNING AND INFORMATION TECHNOLOGY

Organizational learning is enabled most directly by flows of information about events which occur internally and externally to the company (Drucker, 1997). Organizational learning is a top management policy and is guided by the information delivered in the proper format by IT systems.

An example of an IT-enabled organizational program is an internal campaign entitled "A Thousand Ideas for a Better Tomorrow." The president stated: "The proposals are sometimes very simple but no one had seen it before - how to save material or energy [during production], make some machine run more efficiently, and how to improve product quality. [Ideas] which lower costs, improve product quality, increase productivity, or enhance environmental protection, are welcome."

The IT department proposed, designed, and implemented a computer-based information system for capturing, storing, and evaluating proposals in terms of technical and economic feasibility. This information system enables classifying proposals by name of the originator, name of the department of origin, type of technology involved, cost of implementation, economic benefit, and other factors.

Table 1 shows that the company has an active policy for teaching employees to become communicatively competent. However, to adequately support company-wide communication, Sava recently introduced an extensive E-mail system. The president explained: "IT plays a big role...with it communication among individuals is on a more [sophisticated] level...[Employees] are better informed...This is a stimulus [for] seeking still more information and [so] to be a better informed employee...I see a [definite] relation between IT and the better informed employee."

Top management is also concerned with the company's logistics because too often some product shipments go awry. Sava's logistics function is as yet not well-developed - parts purchasing, bill preparation, warehousing, and distribution all occur independently. The company's E-mail system in conjunction with a planned electronic data interchange (EDI) system will integrate these operations. Reflecting on the contribution that the E-mail and EDI systems will have on company operations the president stated: "Our vision is to fulfill four important goals - to 1) satisfy our customers, 2) workers, 3) shareholders, and to 4) respect our environment. All these goals have to harmonize, one should not be achieved at the expense of the others...The Internet is, perhaps, one of the most important information systems [to achieve these goals]."

The aforementioned cases illustrate that Sava has a well established IT system for supporting the company's day-to-day activities. Furthermore, in recent years the company made important strides toward informating functions which directly impact the company's aim to improve its operations and market position through organizational learning.

CONCLUSION

This case demonstrates that the need for organizational learning is not limited to companies located in Western industrialized countries. In the case of Sava, IT-induced increases in complexities and environmental uncertainties were made worse by vast economic, political, and ideological factors. In response to the aforementioned pressures Sava embarked on an extensive organizational transformation which was accompanied by a company-wide commitment to IT-supported organizational learning. The various elements of organizational learning led to a complete organizational transformation of the company. Sava developed from a rubber tire producing company with a relatively stable market in the former Yugoslavia into a competitive player in the global automotive tire market.

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TEACHING SOFT OPERATIONAL RESEARCH IN ASIA: MISSION IMPOSSIBLE?

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Some people argue that theories both reflect and are bound by the cultures in which they are formulated. If this is the case, then it would suggest that transferring the theory to another culture may be problematic. The paper briefly describes a methodology (Soft Systems methodology) derived from the British intellectual tradition, and suggests that it contained elements that facilitated its transfer to another culture. Experiences in teaching SSM in Hong Kong are briefly discussed.

INTRODUCTION

Soft Operational Research (OR) is essentially a product of the British intellectual tradition. As a discipline it arose as a response to growing concerns expressed primarily in the United Kingdom that traditional (Hard) Operational Research was failing to deliver satisfactory results when applied to more strategic, highly interconnected organisational problem situations (Jackson 1987). Increasingly during the 1970s and 1980s, previously reliable quantitative approaches to problem solving were found to be limited in their area of application, and were perceived to be relatively ineffective when applied to problems in which human beliefs, perceptions, values and motivations were key factors in the problem context (Jackson 1991). Soft OR methodologies, with their different philosophical backdrop, have now established a tradition of successful intervention in such problem situations.

Arguments have been expressed that theories both reflect and are bound by the cultures in which they are formulated (Hofstede 1984). Thus, soft operational research theory could be argued to be a product of the British intellectual middle-class culture. As differences between these British traditions and similar ones in Australia have been shown to be very minor (Hofstede 1984, Hofstede and Bond 1988), there should be few surprises that the transfer of knowledge of soft OR from the United Kingdom to Australian practitioners via Australian universities has been reasonably successful.

Having established successful postgraduate programmes in Australian universities and helped to disseminate understanding of soft OR amongst practicing IS professionals, the authors were faced with the challenge of mounting a similar course in various Asian countries as our university started to market its programmes throughout the region. Many colleagues (both academic and professionals from Australia and Asia) said: "You'll never be able to do it! Teach soft OR to the Chinese? They are far too pragmatic!". This paper will describe what we regard as our success in this 'mission impossible': it reports on our experiences in teaching soft OR, specifically Soft Systems Methodology (Checkland 1981), in Hong Kong.

SOFT SYSTEMS METHODOLOGY

Soft Systems Methodology (SSM) was developed in response to perceived limitations of the traditional quantitative modelling approaches that characterised Operational Research in the post-war period. It retains a strong element of modelling of a problem situation in the belief that it is through modelling that problem solvers are enabled to learn about the nature of the perceived problem, and hence find solutions or improvements to that situation. However the quantitative aspects of model construction are abandoned for a combination of text and graphics, based on the precept that many organisational contexts are problematic primarily because there are multiple perspectives on the ends that should be pursued, and that these multiple views of reality can best be captured, shared and understood in a non-quantitative way. Hence there is a shift in focus from how things should be done to what should be done.

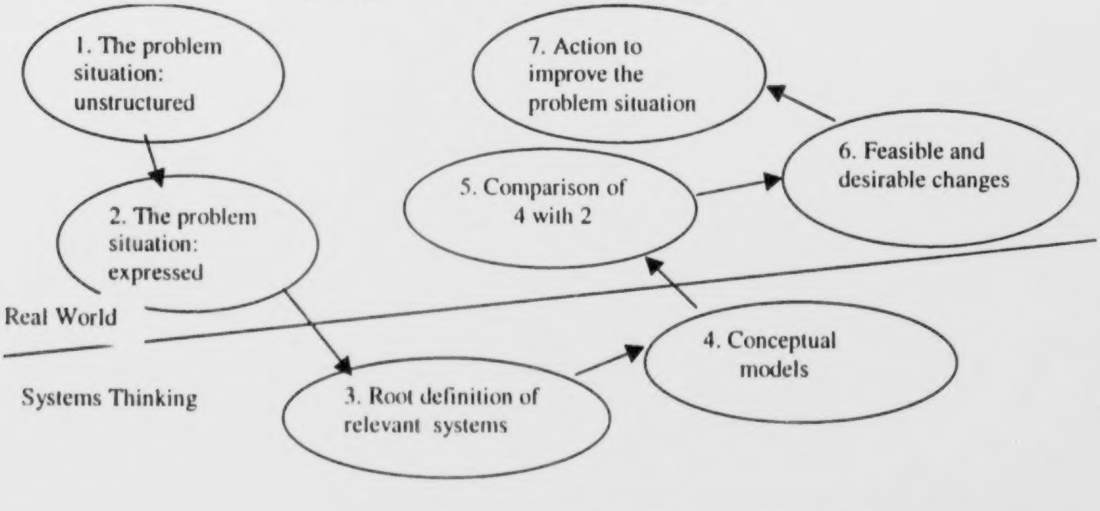
SSM is thus designed for ill-structured, messy problem situations where there is no clear or shared view of what constitutes a given problem, where there is likewise no clear or shared view of what action(s) should be taken, and no obvious solution or answer to the problem. It is best employed in situations where there is at least some willingness to negotiate and compromise (Flood and Jackson 1991).

There are three important elements in SSM. Firstly, it is participative, in that different perspectives are considered valid and these provide a vital means of learning about the problem situation. Participation is also viewed as vital for facilitating implementation of a suite of actions to help improve the problem context. Secondly, SSM emphasizes the importance of culture in a problem context. Culture is viewed as imposing organisational and social constraints which necessarily impact upon potential problem solutions. SSM requires that proposed changes are viewed as being feasible and desirable within any particular cultural context. Thirdly, SSM promotes learning, arguing that only through learning about the nature of the problem and thus the ends that are to be pursued, that one can take decisions and actions that will serve as a means to ameliorate the problem situation (Jackson 1991).

SSM is a seven-stage process of enquiry, illustrated in Figure 1 below. If followed procedurally, SSM is used initially to gather different perspectives on the problem, so that one can move from a situation where the problem is unstructured and not well understood to one where at least a shared understanding of aspects of the problem situation has been achieved. Popular techniques used for this purpose are the rich picture (Patching 1990) and cognitive mapping (Eden 1988).

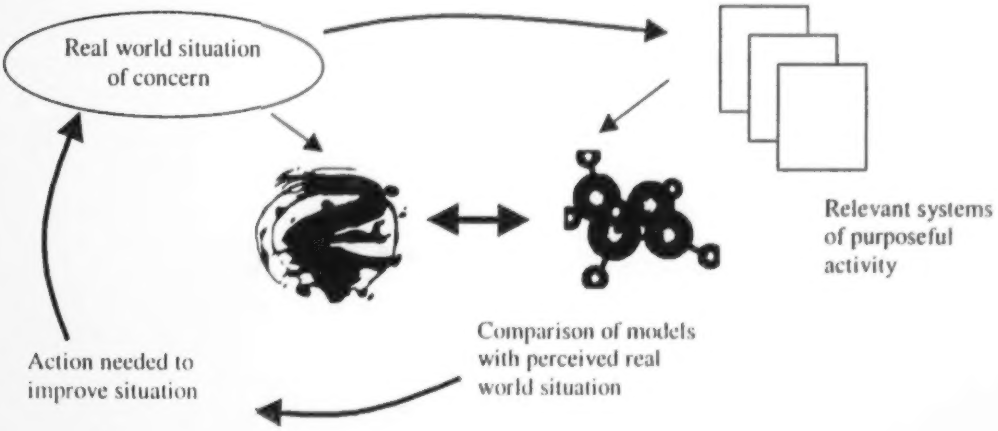
A distinction is drawn between the flow of events of everyday life (the Real World) which is full of constraints, and the Systems World, where problem solvers are asked to think creatively and holistically about ways forward in the problem free of the constraints of the Real World. So called "root definitions" reflecting one perspective of the system of interest are drawn up, based on the mnemonic CATWOE, which includes examination of Customers, Actors, Transformation, Worldview, Owners, Environment. Based on the CATWOE, a conceptual model is then drawn, illustrating the minimum set of activities required to express the system described by the CATWOE. Steps 3 and 4 can be repeated several times, each time reflecting a different perspective on the problem. In Step 5, the ideal systems are compared to the real-life problem situation, allowing feasible and desirable changes to bring about improvement in the situation to be identified (Step 6), and an action plan for implementation to be drawn up (Step 7) (Patching 1990).

FIGURE 1
SSM AS A 7-STAGE PROCESS OF ENQUIRY


1. The problem situation: unstructured
7. Action to improve the problem situation
6. Feasible and desirable changes
5. Comparison of 4 with 2
2. The problem situation: expressed
Real World
4. Conceptual models
Systems Thinking
3. Root definition of relevant systems

Working through the methodology in this way is known as Mode I, essentially taking a step-by-step procedural approach to SSM's use. Our students in Hong Kong, who were mostly systems analysts and business analysts, were somewhat alarmed by this, feeling that some of the techniques in SSM would not be culturally appropriate in their various work contexts. However, SSM is also offered for use in Mode II, as a framework of ideas, which analysts can use to direct their enquiry. When presented as a framework of ideas, SSM appears more like Figure 2 below:

FIGURE 2



Real world situation of concern
Relevant systems of purposeful activity
Comparison of models with perceived real world situation
Action needed to improve situation

The challenge then was twofold: to firstly establish some key principles which underpinned Mode II SSM, and then secondly, to help individual students to appreciate when, where, and in what way(s) they could strengthen their approach to systems analysis by using the methodology. Some of the tenets which radically altered our students' perspectives on problem solving are as follows:

- That there is not a single, central problem "out there" waiting for the systems analyst to find, and then solve. Rather, situations become problematic because of a "suite" of interrelated issues that defy neat, textbook-type situations.
- That those who perceive a situation as problematic are doing just that – perceiving it. There will, therefore, be as many perceptions, mostly differing somewhat or greatly, as there are players in the problem context. These multiple perspectives are all valid, and can all offer insights to facilitate learning about the problem situation. Being able to appreciate and/or accept a different perspective to one's own can help move group members a long way towards ameliorating the problematic situation.
- That constructing models (using text and graphics) is a powerful device for learning, broadening perspectives and gaining insights into the implications of various perspectives.
- That methods, when used purely procedurally, may limit, even cramp the thinking of analysts and group members alike. Rather than seeking critical insights and understanding, it is too easy for the focus of activity to shift to "What step is next?", and for that step to be followed. While systems analysts may often feel confident when clutching onto detailed step-by-step approaches, at the early stages of systems analysis at least, a set of ideas to guide a

learning process of enquiry may ultimately derive better results.

Individual students were encouraged to identify the situation where SSM-guided thinking could be used and how they could adapt the approach to suit their cultural environment. Follow-up over a 12-month period indicates a growing maturity and confidence in applying the framework of ideas of Mode II SSM. Furthermore all analysts feel that their performance has been enhanced through their new understanding.

CONCLUSION

Our experience suggests that there are features of Soft Systems Methodology (SSM) which facilitated its transfer to IS professionals in Hong Kong. At one level, SSM can be taught in purely methodological terms. However, SSM can also be thought of as a framework of ideas, of impacting upon the methodology user's way of viewing the world and problems perceived within that world, rather than being a step-by-step approach to problem solving. In this way, it could be argued to be adaptable and malleable to any cultural perspective. Our challenge was not to teach the methodology *per se*. Rather, the challenge was to encourage students to feel sufficiently confident to 'make the methodology work for them' whatever the context.

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THE APPLICATION OF THEORY OF CONSTRAINTS TO SYSTEMS ANALYSIS AND DESIGN

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INTRODUCTION

Literature has revealed the ineffectiveness of conventional Systems Analysis and Design (SA&D) in delivering accurate, complete, and timely computer information systems within budget. The lack of quality assurance has created complex systems with high maintenance cost (Freedman, 1986). A common sense of long term maintenance problem is inaccurate requirement analysis in the SA&D. By reducing early analysis errors, Mazzucchelli (1985) determine that 64 percent of the system errors could be eliminated. It is necessary to seek new solutions for the crisis surrounding the development and delivery of high quality systems that can be delivered on time and within budget to solve specific problems rather than symptoms.

The Theory of Constraints (TOC) is a quality control theory developed to solve problems in the manufacturing environment (Goldratt & Cox, 1993). Its usage has been expanded into management accounting (Noreen, Smith, & Mackey, 1995), database management (Goldratt, 1990), and other business areas (Goldratt, 1997, 1998; Maday & Watkins, 1997). But it has never been used in conjunction with SA&D. Goldratt's model of TOC examines WHAT to change, WHAT to change to, and HOW to cause the change (Goldratt & Cox, 1993). These questions can be applied directly to system analysis (WHAT) and system design (HOW) in SA&D.

PURPOSE OF THE STUDY

This study was designed to explore the feasibility and effectiveness of applying TOC to SA&D. Because TOC focuses on solving a core problem rather than the symptoms, it was felt TOC would be an ideal framework to focus the system analyst on ensuring that a system is designed and built for the correct problem, not just a symptom. Out of this model grew some theoretical and practical research questions related to the integration of TOC and SA&D with pedagogical issues of implementation.

RESEARCH QUESTIONS

The research questions were: (1) Can TOC be used in SA&D to solve real world problems? (2) Can TOC thinking tools be taught and integrated into SA&D in one semester? and (3) Will TOC increase the accuracy of the SA&D product?

METHOD

Study subjects were students enrolled in one undergraduate SA&D course in a large southeastern university in Fall 1997 (n = 18). Students, in teams of three, were required to complete an SA&D project in a business environment during one semester. Detailed project guidelines were provided for each team to follow. Each team first identified a business problem in a local industry, prepared questions to identify areas of concern, and interviewed the decision-maker in the business area. The undesirable effects of the current system (WHAT to change) were identified and linked to show a cause and effect relationship. Based on the results of the decision-maker's interview, each team developed a Current Reality Tree (CRT) showing the relationships. The established relationships were used by each team to find the central or core problem of the current system.

To validate the CRT, a survey instrument was developed and pilot tested before being administered to line personnel. Once the CRT was validated, the core problem (negative) was converted to a system Goal (positive) to be achieved. To achieve the Goal, the Needs and Wants of the stakeholders were identified. This created an Evaporating Cloud and the underlying assumptions between the Needs and Wants of the participants were examined. In order to achieve the Goal, it was necessary that both sides (management and end users) get their Needs fulfilled (win-win) while one side give up its Wants. TO break the conflict between the Wants of each side, one must examine the underlying assumption related to those Wants. An injection can change the underlying assumption allowing one side to give up its Wants and, therefore, eliminate the conflict of Wants.

Each team then created injections to accomplish the Goal of the system (the opposite of the core problem). With the goal in hand, each team proceeded to utilize Data Flow Diagrams to create a map of the current system which served as a basis for the proposed new system. Each team generated three alternatives (WHAT to change to) and made one recommendation to the decision-maker with supporting arguments. The actual system design, development and implementation were carried out in a project course that followed the SA&D course. The project course addresses the question of HOW to cause the change.

From the second week of the semester, the instructor had a 30-minute weekly meeting with each student team for ten weeks to monitor and review the progress of the SA&D project, the use of TOC thinking tools, and evaluate the quality of the SA&D project. During each weekly meeting, students reported their project progress and asked for further directions. The instructor used creative problem solving to guide students going their problems and issues related to the project and team interactions.

Upon the completion of the project, each team made a practice presentation to the class. Based on the feedback from the class and the instructor, each team finalized its presentation. A formal presentation was made by each team to the decision-maker and line personnel at the business site. After the presentation, the staff members were asked to evaluate the feasibility and the accuracy of the recommended system, completeness of the design, and appropriateness of the alternative solutions. At the end of the course, students were asked to describe the value of this learning experience. They were also required to rate the strengths and weaknesses of their team members, the course, and the instructor.

RESULTS AND DISCUSSION

The results of this study indicated that a new learning paradigm had been created among students resulting in higher quality projects compared to those in previous terms. It was observed that five out of six teams modified their system analysis significantly using the TOC thinking tools. This was the direct result of initial misidentification of the problem, but was corrected by requiring critical thinking to show the cause and effect relationship of symptoms to the problem. It was noticed that teams had experienced difficulty dealing with expanded course content, especially the Goal, Needs, and Wants of the participants and the quality expectations.

Decision-makers and staff at each business site were extremely pleased with the accuracy of analysis, feasibility and completeness of design. They felt that the alternatives were appropriate and the recommendations were accurate. Students indicated that they had a positive learning experience, received support from peers and instructor, and enjoyed the teamwork. Although many students complained of the additional time and effort needed to meet with the instructor each week, they felt the weekly meeting was the most valuable and helpful aspect of the course. During the end-of-semester evaluation, the course and the instructor were highly ranked by the students.

CONCLUSIONS AND RECOMMENDATIONS

The study results indicate that TOC can be used with SA&D to solve real.world business problems. The TOC thinking tools can be effectively taught and integrated into SA&D in one semester. TOC increases the accuracy of SA&D products by forcing the analysts to use deductive reasoning (cause and effect) to identify core problems of the system rather than symptoms.

It is recommended that an experimental study be designed to test the effectiveness of applying TOC to SA&D. The impact of using TOC on the quality of computer systems needs to be further studied.

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MASTER'S PROGRAM IN INFORMATION SECURITY

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James Madison University (JMU) offers a Master of Science degree in Computer Science (MSCS) with a concentration in Information Security (INFOSEC) for information security specialists, computer science and information systems practitioners, programmers and planners in government and private industry. The Master of Science program is attuned to our rapidly changing technological and information society and offers a comprehensive distance learning program of study for professionals in the numerous areas that use information management.

The program is designed to:

- *Develop advanced competencies and the knowledge and skills necessary to understand relationships between information security (INFOSEC) and computer science;*
- *Relate the technical and human components of information security, computer science and information systems; and,*
- *Broaden career potential.*

The 22-month program of weekends and Internet-based education contains 18 credit hours of course work in information security, 9 credit hours in computer science and a 3-credit hour capstone or a 6-credit hour thesis option and a comprehensive examination.

PROGRAM OPPORTUNITIES

The MSCS *distance learning program* at JMU provides professional development opportunities for those employed in information security, as well as information systems managers, computer science professionals, programmers, operations staff, analysts and strategic information planners in government and private industry. The program evolved from the need for continuous improvement by professionals in computer technologies and information security. Its strengths lie in the application of sound theory and principles of information security and computer science in the development and operation of information systems. Key among these principles is listening to both the researcher and the user. The result is a program that provides content relevant to the needs of the information security and computer science professional working in government, the military, industry and academia.

THE PROGRAM DESIGN

The INFOSEC concentration integrated in the MSCS program at *JMU* is uniquely designed to provide an interdisciplinary education in conjunction with a technical background in computer science through Internet-based education. This new contemporary method of education allows working professionals to learn, complete assignments, and obtain feedback conveniently in their homes or offices. This innovative program allows the student to:

- Develop the knowledge and skills necessary to understand the relationship between information security and advancing information systems technology;

- Enhance career alternatives by gaining perspectives required of effective information security managers administrators and practitioners;

- Develop advanced competencies associated with technical, supervisory, policy and related-positions information security and computer science;

- Broaden career potential by planning, implementing and reviewing information security techniques and programs;

- Provide advanced preparation in information security by relating the technical and human components of information security and computer science and information theory in the administration of information systems; and,

- Develop core competencies in database and information system design, in operating systems and networks and in software product development.

ADMISSION REQUIREMENTS

The admission decision focuses on the "whole person concept" which considers work experience, courses and training while employed in industry or government, prior academic achievement and the Graduate Record Examination. It is during the enrollment process that the computer science department, in consultation with the applicant, will evaluate the individual's knowledge, experience and training to determine if any conditional computer science courses shown below will be required. Foreign students may be required to take the Test of English as a Foreign Language(TOEFL) and have proof of availability of adequate funds for the duration of the program.

Minimum admission requirements include submission of:
- Baccalaureate degree from a regionally-accredited institution;
- Current Graduate Record Examination scores (taken within 5 years);
- Official transcripts from all institutions attended;
- Credential evaluation for international transcripts provided by the applicant; and,
- Names of two supervisors or employers who are knowledgeable about the individual's performance.

PROGRAM COMPLETION REQUIREMENTS

- Complete all graduate admission requirements before starting the degree program;
- Complete all the course requirements for a concentration in Information Security;
- Complete all the course requirements in the computer science core;
- Complete the capstone experience or thesis option and comprehensive examination;
- Receive no more than two "C" grades in all graduate courses;
- Earn a minimum of 30 graduate hours of credit applicable to the program;
- Complete all degree requirements within six years; and,
- Receive the recommendation of satisfactory program completion from the program coordinator.

COMPUTER SCIENCE PREPATORY

- CS 510 Accelerated Fundamentals of Computer Programming (3 hours)
- CS 511 Accelerated Fundamentals of Computer Systems (3 hours)
- CS 512 Advanced Fundamentals of Computer Programming (3 hours)

COMPUTER SCIENCE CORE

- CS 550 Operating Systems I (3 hours)
- CS 555 Software Design Paradigms (3 hours)
- CS 574 Database Systems I (3 hours)

INFORMATION SECURITY CONCENTRATION

- CS 621 Trusted Operating Systems (3 hours)
- CS 622 Computer Security Configuration Management (3 hours)
- CS 623 Introduction To Information Security (3 hours)
- CS 625 Audit Controls in Information Security (3 hours)
- CS 626 Information System Vulnerability and Risk Analysis (3 hours)
- CS 627 Secure Transmissions (3 hours)
- CS 628 Advanced Cryptography (3 hours)
- CS 63X Cryptography (3 hours)
- CS 633 Trusted Databases (3 hours)
- CS 635 Policy, Legal Issues and Ethics (3 hours)

CAPSTONE OR THESIS OPTION

- CS 690 Information Security Engineering Capstone (3 hours)
- CS 700 Thesis Option (Independent Study) (6 hours)

INSTRUCTIONAL METHODS

James Madison University courses are conducted using the following methods:

- Lectures in the (weekend) classroom and via the *Internet and other distance learning options* by faculty in which basic and advanced concepts are presented;

- Readings which support and supplement ideas presented in lectures;

- Guest speakers from various corporations and government agencies associated with INFOSEC management;

- Use of personal computers to link directly into *JMU's* academic cluster of UNIX systems to conduct professional research and to develop, test and analyze concepts;

- Internet discussion groups, during which concepts are examined, discussed and critically evaluated and which include:

Simulations and case studies in which management methods and procedures are applied to resolve various types of problems and to handle diverse kinds of situations;

Internet workshops in which students, organized in small study groups, apply their growing knowledge to the examination of selected situations and issues;

Enrichment by the free and open examination of ideas and experiences between and among the students and the faculty; and,

Projects which may focus on the work environment in which students solve INFOSEC Issues.

THE SKILLS AUDIT APPROACH TO FACILITATE UNDERGRADUATE LEARNING

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Changes in the UK education system have resulted in a lack of formative (i.e., student feedback) assessment: increased student numbers and reduced funding resulting in bigger student classes with less tutor contact; also, a more diverse set of student entrants with a wider set of skills, resulting in a bigger need formative assessment. It has become increasingly difficult in the IS/IT field to monitor individual student performance and give individual feedback and direction. This paper examines one mechanism to address this difficulty, a skills audit approach. The use of a skills audit approach is described for three units, two at level 1 and one at level 3 of undergraduate study. Discussion is given on the pedagogic value of the skills audit approach for different level of study. A self audit approach seems particularly relevant for meeting the formative assessment needs of students and encouraging self study and ownership. There are clear indications of the suitability of such an approach for distance learning.

INTRODUCTION AND BACKGROUND

The expansion of Higher Education (HE) in the UK over the last decade, coupled with the reduction in funding per student, has had many effects on the teaching and learning process. Notably, larger class sizes, increased competition for books and study resources, reduced access to tutorial support from faculty and less detailed or frequent feedback on progress and course-work (Gibbs, Lucas and Simonite 1996, p261). These changes have been further exasperated by the increased variety of entry routes, including NVQs (National Vocational Qualifications), GNVQs (General National Vocational Qualifications), mature students as well as the traditional A' levels (Hyland 1994; Burke 1995), with each of these routes fostering and developing different skill sets in students. This greater variety of entrant skills to HE increases the need for individual feedback and support to students, however, as already highlighted, increased student numbers and reduced funds per student have resulted in *less* detailed and frequent feedback and faculty support.

The need for individual feedback on student progress is probably more pronounced in Information Systems/ Information Technology (IS/IT) related courses and units where further influences have taken place. The topic areas are in a continual state of flux with the depth and breadth of technology related issues increasing. The skill base of entrants to HE are changing with greater computer literacy for some students and more to learn for the non computer literate. The destination of graduates, the business environment, is also in a state of flux with new IT related business practices and further reliance on IT. Additionally there has been a wider integration of technology into the teaching and learning process (Grandgenett et al 1997; Kapur and Stillman 1997).

From a teaching perspective it has become increasingly difficult in the IS/IT field to monitor individual student performance and give individual feedback and direction.

This paper examines one mechanism to address this inconsistency by using a Skills Audit to provide individual feedback and monitoring. In addition the Skills Audit techniques promote independent learning skills. Student learning requirements change over levels of study, for instance level 3 students are typically more self reliant in their studies (Adams and King 1994). This paper describes the use of a Skills Audit on three units offered on Business courses, two of the units being core level 1 units, while the other is an elective unit.

The rest of this paper is structure as follows. First the individual cases of using skills audit are described. The paper then discusses the pedagogic justification of such an approach with discussion of how it may be applied at different levels of study and different modes of study, including distance learning. Finally, the salient points of skills audit for each level of study are summarised along with a discussion of its use as a distance learning tool.

SKILLS AUDIT: THREE CASES

Skills Audit has been used on three units at the Southampton Business School. The units are *Information Systems* and *Business Skills*, both core level 1 units, and *Computer Auditing*, a optional level 3 unit. All the students on the units are studying business related degrees. For each of these units a 15 week semester system is used, consisting of 12 weeks taught classes with revision and exams in the final weeks.

A skills audit approach has been used differently in each of these three cases. The differences apply to who are the main recipients of the audit and what they do with the results. The differences also relate to the level of study and the associated learning requires, e.g. level 3 students are typically more independent learners.

The following is a description of each of the cases.

Level 1 Unit: Business Skills

On the Business Schools Undergraduate Programme (BSUP), all students take the Business Skills unit which incorporates maths, IT and literacy. A skills audit was used on the maths element of the unit and comprised of new entrants taking a computer marked diagnostic maths test in induction week.

The background of the unit and the move towards a skills audit approach, centre on the main problems encountered due to the wide variety of skills for new entrants. For business related degrees, a wide variety of entry qualifications were accepted. So typically tutorial groups would include students with maths skills ranging from good Advanced (A') Level mathematics to mature students with little or no formal qualifications in maths. This resulted in tutorial material being not relevant to many students: the students with good maths skills found the sessions too easy, while students with poor maths skills found the sessions too difficult.

What was needed was a mechanism to identify the maths skills of individual students, give individual feedback to students and to enable further guidance to be given to the less able students. The result was developing a computer marked maths diagnostic test which each student took in induction week. Individual feedback was then given to students within a week of the test. The feedback consisted of an overall mark, and more importantly, an indication of how well they performed in four key areas of maths, these being Arithmetic Skills, Estimating Skills, Averaging Skills and Algebraic Skills. In addition, it was indicated where students were particularly week and should seek further support from the Study Assistance who deal with remedial work. A self study learning pack was developed covering the numeracy items being tested. Students that performed sufficiently well on the diagnostic test were APL'ed from the numeracy element of the Business Skills unit, enabling them to devote more attention on the other elements of the skills unit.

The overall result of the approach was more efficient use of staff and student resources. Students had better feedback on where their strengths and weaknesses lie, and on where to direct their study. Staff were able to identify weaker students earlier and direct them to Study Assistance. Also staff in the tutorial sessions were able to concentrate on problem areas since the self study material enabled students to work at their own pace.

The approach has developed over the last three years with some minor modifications each year. The skills team are currently fairly happy with the existing structure, in addition all the student performance is recorded in a database in which staff can monitor the overall skill-set of new entrants from year to year.

Level 1 Unit: Information Systems

The Information Systems unit covered current technology, organisational aspects, and systems theory. The original assessment for this unit was a written report assignment, usually towards the end of the semester, with an end of semester exam. This proved inappropriate for identifying weaker students early on, and feedback to students was typically too late. As with the skills unit another main problem was the wide variety of knowledge and skills of the new entrants, typically, with some student having high level of practical (though selective) IT skills gained in a working environment, along students with very low IT skills.

A different approach to skills audit was taken on this unit. The audit consisted of two short tests during the semester, one in week 5 the other in week 8. The tests entailed a bank of multi-choice questions and an essay question. The first test covered mainly technology issues, while the second test covered mainly organisational issues. The test scripts were handed back to students with appropriate comments and correct answers. Typically the scripts were handed back in the week following the test. The use of multi-choice questions facilitated quicker marking, though more effort was needed in developing the bank of questions. This was an audit *after* students had studied a topic area, so effectively auditing the effectiveness of students studying in a topic area. The results were monitored by the unit leader. This enabled the identification of weaker students earlier on and, enabling further direction to be given in preparation for the following test and the final end of semester exam. Also, it enabled overall areas of weakness to be identified, which could then be addressed in the following lectures and be given greater attention in the following year. The multi-choice questions we used as an indication of the breadth of background reading done by the students, where as the essay was used to show the depth of study undertaken.

Overall the students were fairly positive to the assessment method, liking particularly the quick feedback and the mix of multi-choice and essay questions.

Level 3 Unit, Computer Auditing

The Computer Auditing unit covers security, management, legal and financial auditing issues of using technology in business. The students were from different courses including Accountancy, Business Studies and direct entrants into level 3 from HND courses. Effectively, the students taking the unit had a variety of different skills sets. The problem I faced here was "*how do I give individual feedback covering understanding in a wide set of issues, to 40 students, which I see only a few hours a week, and who will be at different levels in each of the topics?*".

A skills audit approach was adopted to meet the formative assessment needs of these students. The approach differed to that used with level one students, by incorporating more self assessment and peer review. At the start of each topic area a list of items to be covered was produced, an example is shown in figure 1, which covers the legal aspects. Students were then asked to go through the list, individually, and identify how much they knew about each item. Students then worked in small groups going through the list and discussing each item. The discussion included items such as: what constitutes "Very low", "Medium" and "High" levels of understanding/ knowledge?; and where to find information about the topic. Each group generated a list of three items that the group knew most about and the three items that the group knew least about. These were then fed back to the other students and tutor. The only feedback to the tutor from these lists were the three most and least known about topic areas. This enabled some modification to the delivery and content of the topic material (particularly references) to meet the needs of a particular cohort.

Students kept their own lists so they could see where to concentrate their efforts and monitor their own progress. If students had problems with a particular topic, their list could be used as a focus to identify where they are in their studies and what they need to concentrate attention on.

The students were given guidelines of the attainment level expected from them by the end of the unit. This differed for each topic, an example would be "achieve all items in the Medium category and a third of the items in the High category". So providing students cover all the items to the required minimum level (i.e., Medium), they could select which items to concentrate on for in-depth study. Further refinement in the guidance could be given, for instance stipulating core items that students are expected to achieve a high level of knowledge in, however, this was not used on this unit, the intention being to get the students to have responsibility for their own study which included identifying which topics to focus on.

The unit assessment was designed to recognise and complement this self selection of topics. The assessment consisted of students researching into their own selected topic area (within the confines of the unit), and involved producing a written report and a presentation to the rest of the class. In addition, a case study assessment was used at the end of the unit in which a range of issues from each topic would be relevant, enabling students to demonstrate and apply their in-depth learning in their selected items.

Students were encouraged to review their own progress by examining their own list at the end of the topic. This way they could see the 'value addedness' of their study.

Feedback from students on the use of this technique was generally very positive. Some of the comments include "it helps to know what to read about" and "helps to concentrate study". It also seemed to help to reduce the alienation of students with some topic areas. For instance, in topics where many students recorded their knowledge as very low for most of the items, it proved useful to see that their knowledge profiles for the topic was not too

FIGURE 1
SKILLS AUDIT FOR LEGAL ASPECTS

	Level of Knowledge/ understanding		
Item (please add your own description)	Very low	Medium	High
Data Protection Act (general details of)			
Data Protection Act - eight principles			
Changes in Data Protection legislation for EC Directive for October 1998			
FAST			
BSA			
Legal Aspects of using E-commerce			
Searching for Legal information (past and current acts of Parliament)			
Negligence Law relevant to IT			
Contract Law relevant to IT			
Legal issues of the Year 2000 'bug'			
Computer Misuses act			
Legal responsibilities for people using IT			
Legal issues covering access to 'Outsourced' source code (if someone provides you software do you have a legal right to access the source code?)			
In a computing environment, what items can be covered by insurance?			
Warranties			
Intellectual property rights			

dissimilar to others and to promote discuss of what level of knowledge they should be aiming for in the topic. Overall, I found the technique very powerful in encouraging students to take responsibility for their own study.

DISCUSSION: THE PEDAGOGY OF SKILLS AUDIT

Changes, debate and writings on assessment issues in higher education has a long history (Tillyard 1913; Winter 1993, p365); change in education is not new and is an evolutionary process. Much of the recent literature deals with how to maintain quality in the assessment process while student numbers increase and resources are reduced (Gibbs, Lucas and Simonite 1996, p261). Many of these works examine innovative assessments such as self assessment and peer assessment (Gibbs 1989; Gibbs and Jenkins 1992; Hughes and Large 1993; Boud 1981, 1986; Adams and King 1993; Cheng and Warren 1997). The debate over assessment is very current and is likely to continue with the impending changes in higher education (Jacobs 1997). The debate is further enhanced with the advances in technology making distance learning more attractive, and raises several questions on how to assess from a far, both summatively and formatively (Minoli 1997; Kapur and Stillman 1997). The resulting increased variety of entry routes, with their corresponding diversity of skill-sets, highlight the need for a monitoring device for the changing skill-set on new entrants. An initial skills audit, such as described in the Business Skills case in this paper, is one such example.

Probably the most common connotation of auditing is the accountancy sense of auditing a company's financial information (e.g. BPP 1997). A wider definition would include such items as 'to examine', 'to verify', 'to take stock', 'to check'. Defining auditing within a particular area will be very context related, for instance, audit in a computing sense would include such items as 'check on the accuracy and completeness of the results of computer processing' and 'check how efficiently a computer is being used' (Galland 1983) or more currently, checking on a range of items such as software licences and access controls (Alter 1996).

A key aspect of auditing from a student skills perspective would be the 'taking stock' of student knowledge. This already takes place in most institutions, typically before a course starts or at the end of a course. 'Taking stock' of student skills at the start of a course will include setting and checking pre-requisite entry qualifications, so that faculty can expect a minimum level of skills from the student cohort. 'Taking stock' at the end of a course (e.g. an exam) gives an indication that students have met the learning and attainment criteria for that course. The results of this taking stock is used by faculty, students and others. What is less widely used is the 'taking stock' during the course and, the use of that 'taking stock' by the students during the course. This sort of auditing of student skills is not new and has been used successfully elsewhere, a good example being the Maths Science Inventory (LeBold, Budny and Ward 1998).

As can be seen, some sort of skills audit is already widely used in higher education, usually at the start and end of a course. However, less commonly used is the self student audits during the course. The self skills audit can be considered as a Self Assessment Skill Activity (SASA) (Adams and King 1994) that can be used to develop student learning patterns especially if a systematic approach is taken (Boud 1986, p27). Though the skills audit for the level 3 unit described in this paper does not form part of the formal (summative) assessment, it would only take a small step to make it so. A self audit may be an excellent start for a learning contract (Sutherland 1997, p193; Brown and Knight 1994, p90). As such a skills audit could meet the *summative*, i.e., giving a mark, and *formative*, i.e., giving feedback, aspects of assessment and encourage more learning independence in the students.

A self skills audit seems particularly relevant for distance learners. As has been discussed elsewhere, distance learners have a unique set of assessment needs and associated problems (Harris and Bell 1994, p164; Minoli 1996), particularly when it comes to feedback and contact with other students and staff. A self assessment of own skills would go some way to meet the feedback needs of distance learners. It may also be used as a focus for discussion between students and between staff and students, especially if used in conjunction with technology (Kapur and Stillman 1997), such as in providing discussion notice boards, possibly containing group results of self assessments.

SUMMARY

The use of skills audit cases described in this paper shows a progression from level 1 to level 3 of undergraduate study. At level 1, the main aims were to examine the skills of the new entrants enabling early identification of weaker students, quick feedback to the students and, monitoring the delivery of topics within the unit. At level 3, the main aims were to foster self study, changing the emphasis on what the tutors do to what the students do. The use has changed from predominantly a monitoring tool for staff at level for level 1 to a study tool for students at level 3. Level 1 is used as mainly formative assessment, level 3 as mainly summative assessment. Ownership of the audit moves from the tutor in level 1 towards the student at level 3. A self audit seems particularly appropriate for distance learners, especially if used in conjunction with distance learning technology.

Overall, the skills audit approach is a simple yet powerful tool in the teaching and learning process. Given the changes in the UK education system, a skills audit has use as a monitoring device for the changing skill-set on new entrants. The changes in education results in a broader skill-set of a cohort of students along with reduced feedback to individual student, i.e., a reduction in formative feedback. It is increasingly difficult in the IS/IT field to monitor individual student performance and give individual feedback and direction. The use of a self skills audit provides one mechanism to meet the formative feedback needs of students. This seems particularly appropriate for distance learning.

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EVALUATING THE CHANGING END-USER ENVIRONMENT: WHAT ARE THE NEW SKILL SETS?

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Advances in business technology tools have not only changed the requirements of information systems (IS) professionals, they are moving the locus of control and use to non-IS "knowledge workers". As a result, the skill expectations for non-IS professionals are becoming increasingly more sophisticated. This study focuses on accountants as one subset of the knowledge worker class, evaluating job classified advertisements in terms of the required systems skills. As predicted, technological expertise in the areas of database management and client/server technology become a differentiating factor as accounting job advertisements shift from entry-level to higher-level positions.

INTRODUCTION

As information technology (IT) requirements become more pervasive throughout business organizations, typically outstripping the available information systems (IS) staff resources, many organizations have turned to end-user tools to meet increasing information demands. Certainly, end-user technology has increased in sophistication, providing powerful programming and presentation capabilities with a simple and intuitive user interface. The non-IS "knowledge worker" has also gained in technological expertise, honing data manipulation skills with a variety of microcomputer-based applications.

A well-organized systems architecture with an integrative set of end-user tools moves the locus of control from the systems developers (who may be constrained by a set of technological objectives) to those who are actively asking the questions and using the information. Successful implementation can reduce the IT maintenance burden resulting from system incompatibilities and a continually increasing backlog of application requests as well as promote the effective use of information resources throughout an organization (Hirschheim, Klein, and Lyytinen, 1995). Unfortunately, the converse is also true, a non-integrative framework can create dysfunctionalities as users attempt to develop partial or stand-alone solutions.

The research issue examined in this paper is: given this changing environment of end-user computing, what is the current expectation level for IT end-user skills in the workplace? Although there are many types of end-users, the scope of this study is limited to accountants as a single category for the following reasons:

- Accountants have a robust tradition of working with business information and in particular, databases--including the venerable general ledger financial accounting system (which is a database, although not explicitly taught as such). (Elliott, 1992)
- Current accounting practice is moving towards the integration of non-financial business measures with standard financial accounting data. This provides accountants an incentive to augment traditional general ledger systems with additional accounting databases. (Essex, 1997)
- The accounting profession has made a concerted effort to promote IT training and use through its professional organizations and continuing educational requirements. (AICPA, 1997)
- Software developers are responding to the changing user requirements of accountants by offering new, sophisticated tools. For example, several accounting software vendors are now offering SQL add-ons tools to their financial accounting applications. (Scott, 1998)

Because so much of accounting is based on transaction data sets, this research suggests that, as accounting graduates progress through increasing levels of responsibility and expertise, an important discriminating end-user skill is the ability to understand and analyze database information. The proposed methodology for testing this hypothesis is to examine the IT skill sets required by employers for entry-level accounting jobs as opposed to employment opportunities for experienced accountant applicants.

Research Methodology

Utilizing a methodology employed by earlier IAIM researchers (Case, Price and Rogers, 1997) to determine the job market requirements for new hires in the IS field, the classified employment advertisements for *The Washington Post* are scanned for openings in accounting positions. After eliminating those jobs that do not require a college degree, the remaining advertisements will be partitioned between entry-level jobs (generally requiring less than 2 years work experience) and opportunities requiring longer business experience. A content analysis of the remaining advertisements will be conducted to evaluate the employment criteria utilizing the following parameters:

1. **General computer skills.** Example: "Successful candidate with have a Bachelor's degree (accounting major); five to ten years related work experience (budgets and grants management; excellent verbal and written communication skill; *computer proficiency required.*"

2. **Spreadsheet proficiency.** Example: "Qualifications include; B.S. in accounting or related field; minimum 5 years of accounting financial-related experience; *computer experience--spreadsheet and word processing software. Excel and Lotus are mandatory.*"

3. **Database proficiency.** Example: "Management Accounting Specialist position requires 2 years experience in cost accounting; *ability to organize and interpret large volumes of data; proficiency in the use of PC, spreadsheet and database software.*

4. **Familiarity with specific Accounting packages.** Example: "Accounting degree (CPA) required), a minimum of two years public accounting or relevant industry experience, budget and forecasting experience preferred, strong technical, analytical and interpersonal skills...advanced MS Office skills, *and experience with automated accounting systems (Platinum a definite plus).*"

5. **Experience with client/server issues.** Example "To qualify, you need a BS in accounting and *2 years of experience installing client/server accounting software (Great Plains G/L system and Hyperion preferred)*...experience maintaining system databases/documentation is preferred."

It should be noted that these are not mutually exclusive categories. Frequently a single advertisement would contain more than one of these parameters.

Analysis Results

A preliminary analysis of the classified advertisements in the April 26, 1998 issue of the Sunday *Washington Post* newspaper yielded 113 accounting positions. Of these, 25 were for entry level positions; the remaining 88 were for experienced (requiring at least 2 years of prior job-related experience) accountants. A closer examination of the requirements for the two groups provided the results shown below:

TABLE 1
CLASSIFIED ADVERTISEMENT ANALYSIS

Job Requirement Criteria	Number/Percentage of All (113) Jobs		Number/Percentage of Entry Level (25) Jobs		Number/Percentage of Experienced (88) Jobs	
General Computer Skills	87	77%	19	76%	68	77%
Spreadsheet Proficiency	58	51%	15	60%	43	49%
Database Proficiency	20	18%	1	4%	19	22%
Familiarity with specific Accounting Software	34	30%	6	24%	28	32%
Experience with Client/Server Issues	10	9%	0	0%	10	11%

BEST COPY AVAILABLE

The general requirement for computer related skills is consistent across all jobs. There are differences; however, in each of the other job requirement categories, with the most significant changes occurring in the parameters for Database Proficiency and Experience with Client/Server Issues. In the former, the proportion of jobs stipulating database expertise increased by a factor of 5.5 from entry level to experienced positions. With regard to experience with client/server issues, the results were even more startling--none of the entry-level openings indicated required knowledge of a client/server environment, yet 11% of the experienced job positions contained this requirement.

One additional anecdotal comment should be noted. The most popular accounting software packages mentioned in the classified advertisements were Platinum, Great Plains and Solomon software--all of which have recently released a set of SQL tools for their accounting packages (Scott, 1998). A review of each of these products indicates that they are providing increasingly sophisticated data analysis tools, such as on-line analytical processing (OLAP), as well as integration with object-driven application development tools such as Visual Basic.

Implications and Future Research

The preliminary findings suggest that the technical expertise requirements for non-IS knowledge workers are becoming increasingly sophisticated. Business organizations are not only requiring data manipulation and analysis from their non-IS staff; they are expecting competency with powerful end-user technologies. With regard to particular applications, the user may have more detailed and specific knowledge of the software tool than the more generalist IS support person. In some respects, the traditional IS and end-user roles are now reversed. The end-user may now be in possession of technical expertise with regard to a specific application, while the IS professional must address larger and more conceptual issues. This has potential ramifications for IS students, who must move beyond simple technical expertise to integration of diverse and possibly multidimensional databases. What is the optimum support methodology and systems architecture approach that can provide an efficient and coordinated use of IT resources when non-IS professionals will perform a large portion of the data access and manipulation?

There are additional areas of research relating to the IS training provided to students in non-IS disciplines such as accounting. Does the typical undergraduate and/or graduate business curricula address these new technologies and end-user capabilities? What should be the role of the IS department in addressing these interdisciplinary issues? One possibility is to introduce both IS and non-IS students to an integrated business application—for example an integrated accounting system. This approach would allow the accounting students to not only learn the mechanics of the application (this knowledge can be adapted to other packages), but would also provide a working model of an accounting system to examine underlying accounting concepts. The same software could also be used to introduce IS students to the possible end-user issues that might arise with the implementation and maintenance of these types of systems, as well as creating a platform for developing customization skills, in which the standard features are adapted for specific user needs.

Clearly, the end-user environment will continue to change, as the available tools evolve to provide greater flexibility and intuitive user interfaces. As the tools evolve, so will the relationships and locus of control between the IS professional and the non-IS user. These relationships and the shifting end-user skill set must be understood, if business are to achieve the integrated IS architecture that will promote the effective use of information rather than a dysfunctional implementation which, at best, supports only partial pockets of expertise.

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INFORMATION TECHNOLOGY-BASED INSTRUCTIONAL STRATEGIES

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Greater learning can be promoted by delivering information through a variety of media and through the use of interactive applications. In this paper, the effect of information technology on learning is seen as a function of how well interactive technologies support a specific model of learning and how appropriate that model is to the learning situation. Assumptions of learning theories are reviewed and combined with specific technologies. Using the framework provided by Leidner and Jarvenpaa (1995), this paper suggests an educational strategy incorporating various technologies based on these theories and combinations.

INTRODUCTION

Interactive technologies improve the appeal and motivational effects of activities related to learning. However, learning models themselves should not be overlooked; they assist in the selection of appropriate technologies for the learner or the learning environment. The effect of information technology on learning is seen as a function of how well technology supports a specific model of learning and how appropriate that model is to the learning situation [Leidner and Jarvenpaa 1995]. Models also provide a framework for specific Information Technology (IT) functionality for the purpose of the instruction and, the control of pace and content of learning.

Following this premise, this paper reviews the assumptions of learning theories and IT functionality, and combines them with specific technologies. Then, it applies these theories in education and creates a roadmap for deciding which technologies are suitable for specific learning objectives. As each model is defined, an IT functionality is reviewed. Finally, a model combining the learning theories, the functionality, the type of outcome and an appropriate technology is proposed.

LEARNING MODELS

Learning models are often classified in distinct categories. They can be alternated or offered in conjunction, and the use of one model does not exclude the use of another. The broadest categories of this classification are objectivism and constructivism, with subsets including collaborative, cognitive information processing, and sociocultural learning [Leidner and Jarvenpaa, 1995].

Objectivism is a behavioral-type of model that holds that learning occurs in response to an external stimulus. Objectivists profess the existence of an external objective reality that exists independently from the observer. Learning occurs when individuals understand this reality and modify their behavior accordingly. One of the assumptions of this model is that this independent reality can be represented through abstract models and transferred to the learner. In this model, teaching consists of transferring knowledge from the expert to the learner. This transfer can be automated between and among individuals. Efficiency in teaching is measured by the appeal component of the presentation of information. This model is most appropriate for learning "facts" or procedures. It can be used in the situations where facts and figures about an organization need to be distributed. Presentation graphics and slides can portray information in charts highlighting the organization's internal structure, project requirements and other text-based information that needs to be presented in a more appealing mode.

Constructivism is a learning model that starts from opposite assumptions from objectivism. In this model, learning is not as much a process of knowledge assimilation as it is a basis for constructing mental models, in which knowledge is created in the mind of the learner. Constructivism excludes the existence of a reality external to the learner reality. The consequence of this model is that reality differs for each individual and the latter controls the pace and depth of his/her instruction. The instructor is only the mediator in a growth process that requires hypothesizing, questioning and discovering the conceptual relationships between and among various objects. This type of learning can be used for recreating situations in which the student experiences a simulation of the business and then builds his own world based on that simulated understanding.

Cooperative or Collaborative learning is an extension of the constructivist model. The difference lies in the assumption that the creation of mental models is the result not of individual efforts, but of collaboration among individuals that elaborate principles for shared understanding. Knowledge is created through the act of sharing and the instructor is a facilitator of communication. This type of learning increases motivation to explore [Flynn, 1992]. It also increases the level of critical thinking, pushes for a greater diversity of ideas, and promotes interaction. Suitable technologies used in this context are listservs that provide a discussion environment or Internet conferences that promote simultaneous interaction. Discussion groups through collaborative software promoting synchronous communication also fall within this category.

Cognitive Information Processing is another facet of constructivism. It assumes that learners differ in the way they process information and that only the instructional methods that match the individual preferred learning style will be most effective [Bovy, 1981]. Prior knowledge influences these preferences and the learner will select only the information that is built upon that knowledge. In order to focus the attention only on those processes that are most effective to attain understanding, other information will be selectively excluded. Hypermedia, and therefore, Web-based communication is useful in this context. Learners follow the path that best complies with their pre-existing mental maps and can select information accordingly. Applications include Web tutorials and multimedia software in which users focus on the media that is best suited to their learning style.

Sociocultural learning is closer to system-based theories and rejects the idea that learners can create their own images of reality that are apart from the external environment. The living, historical and cultural background of the learner influences the understanding [O'Loughlin, 1992]. This model is particularly useful in distance learning where the delivery of the message needs to take into account the cultural context in which the information is distributed. From an educational standpoint, this is particularly useful in the integration of company culture with the changes brought about by the changes in the adoption of technology. The tacit culture is taken into consideration and the message is adjusted to lessen the impact on the population. The implications for education can be summarized in Figure 1.

FIGURE 1
SUMMARY OF LEARNING MODELS

Model	*Basic Premise*	*Goals*	*Implications for Instruction*
Objectivism	Learning is the uncritical absorption of objective knowledge	Transfer of knowledge from instructor to students	Information is best presented through graphics, figures and other appealing designs that complement text.
Constructivism	Learning is a process of constructing knowledge by an individual	Formation of abstract concepts to represent reality	Learning through recreating experience that simulate direct field visits
Cooperativism	Learning emerges through shared understandings of more than one learner	Promote group-skills – communication, listening, participation	Use of listservs and on-line conferencing to stimulate discussion
Cognitive Information Processing	Learning is the processing and transfer of new knowledge into long-term memory	Improve processing abilities, recall and retention	Use of multimedia or hypertext gives learners the ability to select, organize and process knowledge in a mode that favors long-term retention
Socioculturalism	Learning is subjective and individualistic	Action-oriented, to change society rather than accept or understand	Technology helps preserving competitive advantage from the cooperation on networked computers that favor integration.

Adapted from Leidner and Jarvenpaa [1995:270]

The above relationships between theoretical models of learning and the implications for education are mediated by the technological medium. The role that information technology assumes in each of the described models is further investigated by focusing on the ways IT facilitates learning to meet a specific functionality. Leidner and Jarvenpaa [1995] assign four different functions (automate, informate up, informate down, and transform) to the use of IT for instruction. They propose a taxonomy with two dimensions --- the purpose of instruction (knowledge dissemination vis à vis knowledge creation), and the control of pace and content of learning. In the following sections, the four functions are linked with pertinent technologies for education.

Automate

Automation is used for replacing expensive human labor with technology. Although teaching and learning rarely fit automation, there are parts of these activities that are characterized by repetition and can be delivered more efficiently through visual aids used by the instructor such as transparencies, instructor consoles, stand alone student computers, computer assisted instruction and distance learning. Studies show that the use of slides, outlines, and transparencies contribute to increasing learners' motivation [Janda, 1989]. Although significant differences in performance were not found [Gist, McQuade, Lorenzen, Schmidt, Boudot, & Fuller, 1988-89], the inclusion of automation in the learning setting increases students' liking of the instructor. The latter is primarily acting as a presenter of information, a colorful and organized presentation has effects in gaining attention and promoting comprehension.

Within the automation function of IT, a significant role has been taken by Computer Assisted Instruction (CAI). CAI or other applications of it (Computer Based Training - CBT) consist of interactive software programs that provide information in several modes (sequential as well as non-linear, static as well as dynamic) in order to increase the understanding and mastering of the subject by learners. The assumption is that control of pace and active involvement through feedback is more effective. This structure is still objectivist as the knowledge already exists pre-defined in the system and is not constructed by the learner. The form of interaction is still *stimulus-response-reinforcement* with feedback activities provided through tests, questions and answers. Schwier & Misanchuk [1993] saw this reinforcement as facilitating elicitation and assessment processes. The appropriate technological means to provide this instruction is *multimedia*. Multimedia technology fulfills the automation function by meeting the objectives and operating within the framework of the objectivist model.

Learning through multimedia also adds a component of flexibility, dynamism, and interaction in the amount of information that can be accessed. Multimedia exploits several synchronized media (not just a collection of unrelated multiple media) to obtain learning and to help build cognitive models. It combines the benefits of learning from audio and video components into an environment that offer the user the ability to control the pace of instruction, a major inhibitor in learning from television or radio. For example, in the case of **interactive video**, the use of this tool is essential for stimulating the user to form an opinion. On the basis of the information retrievable on the screen (cases, videos, sound), the user creates the development of the story and makes a value judgment.

The learning process through multimedia promotes formative evaluation, ease of use and navigation. Although research on the effects of multimedia is not definitive, Kuzma [1991] concluded that multimedia remains the most powerful tool for learning by incorporating the benefits of other means of communication into the benefits of learning with computers. Learning with computers is important for the cognitive process requiring building models to promote understanding. As an aspect of multimedia learning, **hypermedia** learning occurs through access to a series of links explaining the context, the meaning of a word, or displaying related video and charts. Access to information is increased exponentially. The drawback is the risk of disorienting the user, particularly if he falls into the category of "linear thinkers" rather than "associative thinkers". The user needs to build a map or storyboard to navigate. However, the use of hyperlinking is particularly appropriate in another representation of the automation function: *distance learning*.

The **distance learning** mode of instruction still consists in simple knowledge transmission introducing the variable of learners now based in different locations. Because of the latter geographical dimension, this application also displays traits of the sociocultural model of learning, as it allows learners to remain in their familiar environment while their learning occurs. This approach does not force users to adopt and adjust to a new culture that could be present in the primary location of instruction.

Informate Up

This function includes a flow of information not only from the provider of instruction to the learners, but also vice versa. The feedback is intended to appraise the instructor on the level of understanding of the material presented and promote the adjustment of the *presentations*. Technological tools that allow this type of feedback are instruments for on-line communication such as email. Although the communication is asynchronous, the ability to ask questions through a medium favors interaction. This interaction could be not otherwise attainable either because of the psychological characteristics of the learner or because of the existence of distance between the source and the recipient of instruction.

Informate Down

Technology allows the provision of information to learners both through the delivery mechanism described in the automation function and by providing communication facilities for the learners. Learning networks are an example of this level that supports the constructivist model of learning: users are forced to create new knowledge based on the information available to them.

Hypermedia can also be included in this function when it stimulates the learner to analyze and organize information [Ambrose, 1991]. Virtual reality is used for this function when it allows simulations that encourage problem solving. The belief is that learners understand best when they experience the subject or topic. Gorrell and Downing [1989] have demonstrated that groups of students using computer simulations outperform control groups at problem solving. Virtual reality allows a "panoramic" view that constructs the closest representation of the actual environment. Learners are actively involved in constructing their knowledge in the virtual world mirroring the actual world.

Other applications of this function can be found in synchronous GroupWare communication settings in which learners communicate anonymously with other students in the same setting. This cooperative learning technology is used in strategy formulation in hierarchical contexts in which suggestions can be hindered by the fear of the authority. In planning, it is useful at the meeting level when decisions on policies need to be formulated.

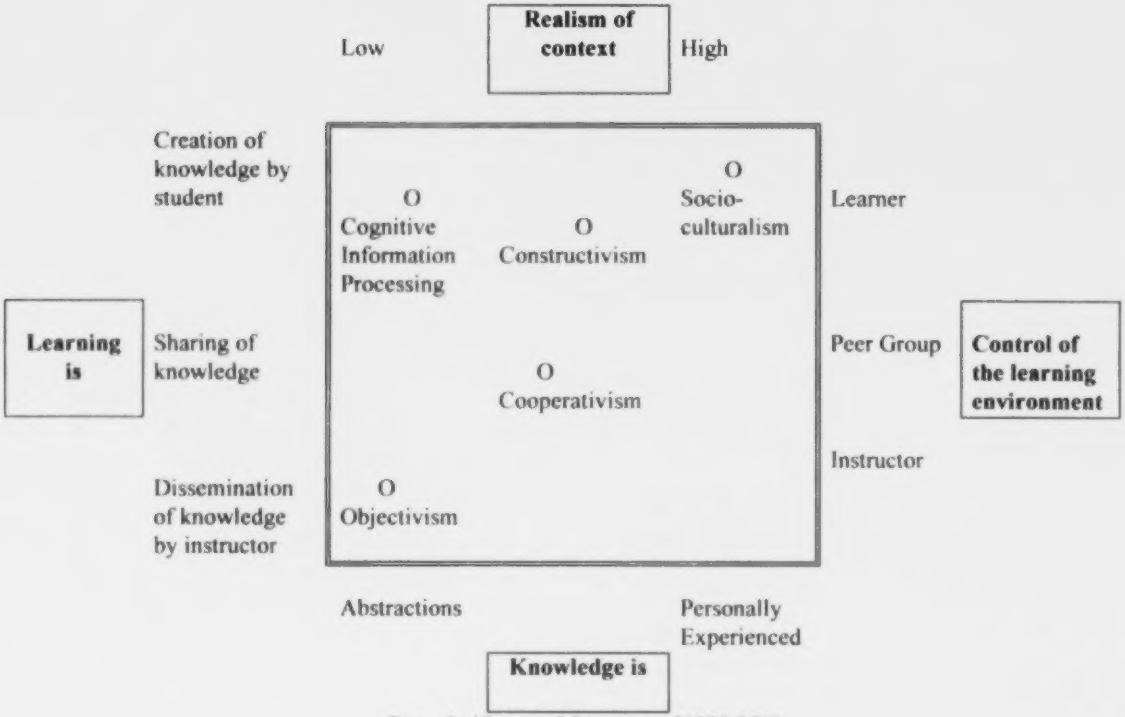
Transform

This function links learners in geographically dispersed locations with no time boundary for interaction. It creates "virtual learning spaces" to which interested parties can refer at any convenient time and on a continuous mode. Examples are Electronic Bulletin Boards, newsgroups, or community information centers. The cognition level of this function is extremely high. This automation function follows the objectivist theory and deals with factual and procedural knowledge transfer. Technology informating down leave the pace of knowledge creation in the hands of the learners. In the strategies for informating up, major emphasis is still on knowledge dissemination and importance is placed on understanding explicit information rather than producing new ones. The technologies promoting transforming start from the assumption that time and locations inhibit knowledge processes. Transforming technologies contribute to a dynamic sharing of tacit information created by the entire group of participants. This method promotes higher order cognition and conceptual learning. The variables of instruction in the above methods can be reviewed in Figures 2 and 3 based on measures such as type and intensity of the variables.

IMPLICATIONS FOR EDUCATION

Figure 2 shows the relative positioning of learning theories in terms of four dimensions: the control of the learning environment, the representation of knowledge, the realism of context and the type of learning. Figure 3 assigns specific technology to the functions previously discussed (automating, informating up and down, transforming). The bottom half of Figure 3 identifies the outcome dimensions and processes of technology use for variables such as motivation, cognition, behavior and performance. To manipulate these variables, Figure 3 suggests using technological tools, classroom structure and instructional models identified in the taxonomy.

FIGURE 2
DIMENSION OF LEARNING THEORIES


Realism of context
Low
High
Creation of knowledge by student
Sharing of knowledge
Dissemination of knowledge by instructor
Learning is
O Cognitive Information Processing
O Constructivism
O Socio-culturalism
O Cooperativism
O Objectivism
Learner
Peer Group
Instructor
Control of the learning environment
Abstractions
Personally Experienced
Knowledge is

From Leidner and Jarvenpaa [1995:271]

FIGURE 3
TAXONOMY OF THE IMPACT OF IT ON LEARNING

	Automating	**Informating Up**	**Informating Down**	**Transforming**
Technology	Instructor Console CAI/CBT Distance learning	Keypad response Instructor-student email	Learning Networks Virtual Reality Simulations	Virtual Learning Spaces
	Instructor Console and Student Workstations		Communications Classroom	
Classroom Structure	Hierarchy/Tree	Star	Ring	Dynamic
Model	Objective	Objective, Cognitive IP	Constructive, Cognitive IP, Collaborative	Collaborative, Cognitive IP, Sociocultural, Constructive

FIGURE 3
(continued)

PROCESS DIMENSIONS

Instructor	Control of pace, Content →	Student
Knowledge dissemination	Purpose of instruction →	Knowledge Creation

OUTCOME DIMENSIONS

Ephemeral	Impact of self-variables (motivation, interest, self-efficacy) →	Long-term
Factual/ Procedural	Impacts on Levels of Learning →	Conceptual
Lower-order thinking	Impact on Cognition →	Higher-order thinking
Low	Impact on Behavior-participation and attention →	High
Improvements on factual/procedural tests	Impact on behavior/performance →	Improvement on conceptual assessment

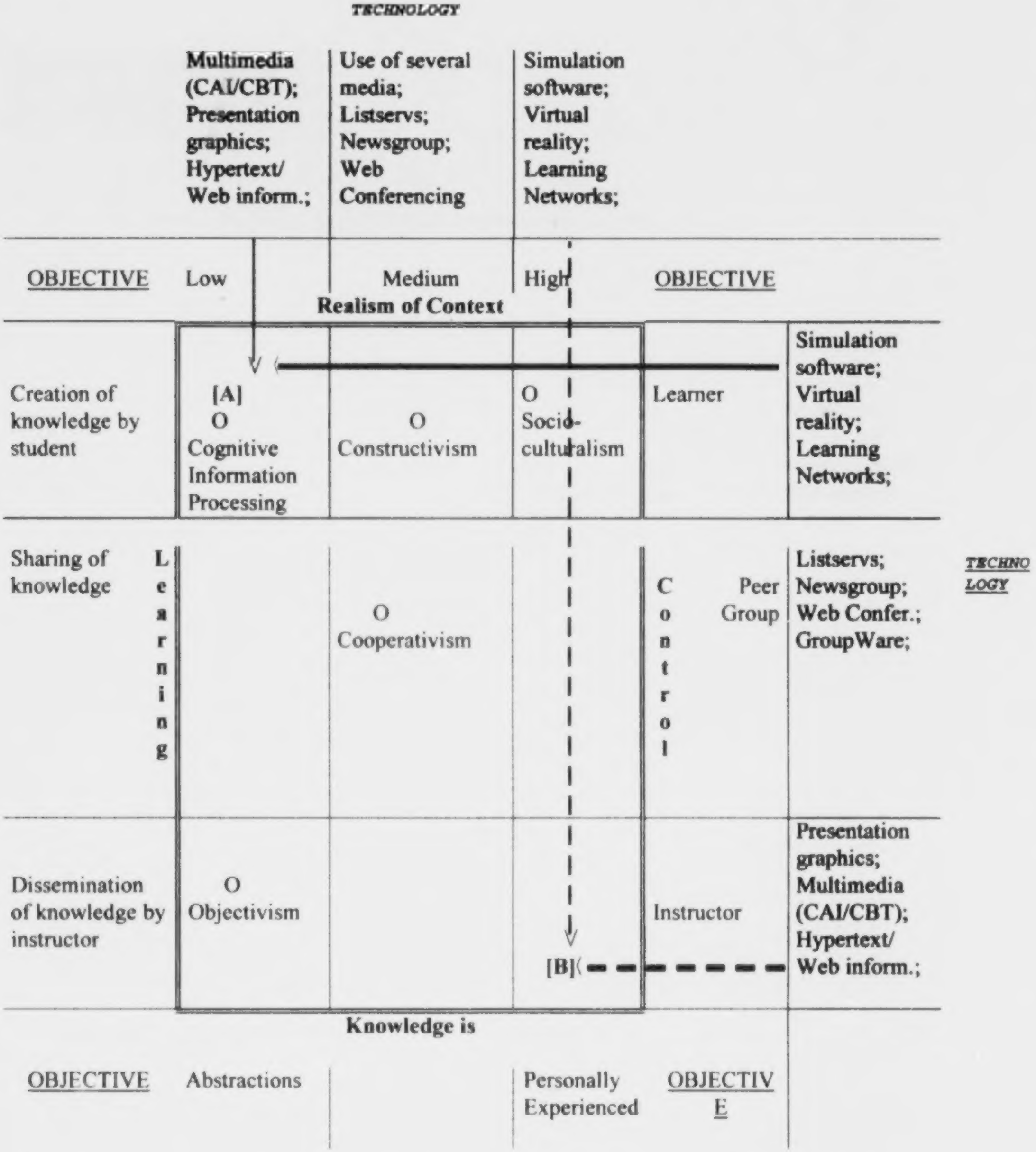
Adjusted from Leidner and Jarvenpaa [1995:284]

The identification shows that the outcomes associated on the right side of the latter diagram lead to higher cognition levels; are learner-centered; involve a higher order of thinking; and obtain longer-term effects. The analysis presented in this literature review confirms that moving left to right (from the automation to the transforming functions) leads to higher level results.

This observation suggests recommending a directional implementation strategy (left to right) to meet the educational goals. For example, one of the goals could be attaining behavioral changes, which Figure 3 suggests. It also shows that the technology suitable for this purpose is the creation of "virtual learning spaces."

Educators, particularly those identifying with the sociocultural model, believe that the different learning theories can be combined to achieve the mentioned objectives. In the taxonomy, for example, transforming is obtained by using multiple models. A "systemic approach" to education would call for such integration. Nevertheless, as some technologies imply higher implementation costs, it is useful to associate specific technologies to specific models. This can be done combining the dimensions of Figure 2 with the technology associated to the learning models and the directional relationships identified in Figure 3 to create Figure 4. Now, Figure 4 is a model for the implementation strategies for education.

FIGURE 4
DIMENSION OF LEARNING THEORIES AND TECHNOLOGY


TECHNOLOGY
Multimedia (CAI/CBT); Presentation graphics; Hypertext/ Web inform.;
Use of several media; Listservs; Newsgroup; Web Conferencing
Simulation software; Virtual reality; Learning Networks;
OBJECTIVE
Low
Medium
High
OBJECTIVE
Realism of Context
Creation of knowledge by student
[A]
O Cognitive Information Processing
O Constructivism
O Socio-culturalism
Learner
Simulation software; Virtual reality; Learning Networks;
Sharing of knowledge
Learning
O Cooperativism
Control
Peer Group
Listservs; Newsgroup; Web Confer.; GroupWare;
TECHNOLOGY
Dissemination of knowledge by instructor
O Objectivism
Instructor
[B]
Presentation graphics; Multimedia (CAI/CBT); Hypertext/ Web inform.;
Knowledge is
OBJECTIVE
Abstractions
Personally Experienced
OBJECTIVE

Combination [A] & [B]= Multimedia, Presentation Graphics, Hypertext, Web for Information & Simulation software, Virtual Reality, Learning Networks with LEARNER & INSTRUCTOR control.

The inclusion of technology in the Figure expands the applications of multiple models for the attainment of educational objectives. If the main target of the education program is to provide control to the learner over the learning activity, then simulation software, virtual reality and learning networks enable not only the attainment of that objective, but also the re-creation of a highly realistic situation in which the learner personally experiences the content of instruction and creates his own knowledge. The sociocultural approach that uses the technology described increases the possibilities to reach the stated objectives. From this integration (Figure 4), it can be inferred that the combination of presentation graphics, multimedia and hypertext with simulation software and virtual reality applications favor knowledge creation by the learner. Since simulation is strongest in learner-controlled instruction with high reality context when applied in a sociocultural model, application in the cognitive information processing model tends to increase realism and the experiential nature of knowledge acquisition. Conversely, the combination [A] can be applied in the opposite dimension [B] to promote the attainment of the same results also in teacher-centered instruction. Therefore, the use of these technologies can remove the boundaries between the identified models of learning and can allow more manipulation of the objective and outcomes of instruction.

SUMMARY AND CONCLUSIONS

This paper reviews the assumptions of learning theories and combines them with specific technologies to analyze the effect of information technology as a function of a specific model of learning and a specific learning situation. It applies these theories to education raising awareness about technology needs and potential. By looking at the expansionary effects of the use of different types of technology on educational objectives, the authors suggest an educational strategy that incorporates various technologies to promote higher levels of cognition and achieve longer-term attitudinal changes in students.

This strategy has consequences in several learning contexts and holds particular promise for education. By looking at the potential for virtual reality applications to simulate personal experience, a new concept can be portrayed, whether it is achieved through learner or instructor control. The high realism of the simulated context can propose itself as a possible substitute of in-class-only instruction. Considering the potential behavioral effects of using other types of media to deliver the same message instructors and curriculum developers, as well as a broader variety of stakeholders (academic institutions, public authorities, and the private sector) need to promote the use of these technologies at all educational levels. Traditional instructional technologies are useful, but, in the long run, the lasting effects will be brought about only by transformation through appropriate and objectives-matched applications.

There are many opportunities waiting to be exploited. Some of these opportunities include:

1. use of Web technologies for creating sites of interest and conducting Web-conferencing activities;
2. use of listservs and newsgroups for discussing system design, programming and database initiatives;
3. use of presentation graphics to better deliver information in the classroom or in training programs;
4. use of multimedia applications to promote self-paced instruction on application packages;
5. use of GroupWare communication and decision support systems (DSS) to brainstorm on strategy implementation;
6. use of distance learning to advance the emergence of a global software development; and, finally,
7. use of virtual reality to attain the most ambitious outcome of recreating business-like learning environments.

Although the use of some of the technologies is limited by the lack of investment in producing expensive software applications, development of this software may be the answer to enhancing learning by increasing participation and interest.

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ISSUES ON THE LEADING EDGE: AN EXAMINATION OF PROBLEMS FACED BY INNOVATIVE INSTRUCTORS OF INFORMATION TECHNOLOGY

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This paper examines the problems faced by instructors of information technology when they try to introduce new technologies for delivering instructional material. The authors have extensive experience in utilizing innovative instructional technologies, and are well aware of the rewards and frustrations encountered on the leading edge. Some of the issues discussed in this paper include:

1. *Dealing with new versions of software, when the institution wants to keep older versions on all of its computers*
2. *Dealing with budgets, both as constraints on resources and as inefficient mechanisms for providing leading edge technology*
3. *Dealing with colleagues, staff, and students who are not always in synch with leading edge needs*
4. *Conversely, we also have to deal with students whose own computers and software are sometimes ahead of our own*
5. *Using innovative technologies to deliver course materials – the rewards and the pitfalls*

INTRODUCTION

This paper is a step along the route that both authors have traveled for many years. It grew out of discussions among colleagues in our CIS department, which led into an eponymous symposium held before our student chapter of the Association for Information Technology Professionals (AITP) at our annual banquet for them. As such, it is the result of our experience and internal discussions, and is not meant as a quantitative research piece. It contains opinions and suggestions. Like most professors of Information Systems over the last two decades, we strive to provide our students with the most up-to-date, relevant, useful, and engaging education we can give within the constraints of time, budgets, university politics, technological change, shifting paradigms, and our own knowledge and endurance. Sometimes (not often), the path seems obvious. At other times, the path may seem obvious to us, but not to our colleagues. Sometimes our discipline shifts so radically as to make one wonder whether we have a real, sustainable discipline to teach.

The introduction of the Internet (to be precise, the making of a TCP-IP connection from our university out to the world) has greatly changed the manner in which we teach. For one thing, the Internet has made many people who might otherwise have been uninterested in computers take an interest; the possibilities for expression, artistic and entrepreneurial, are obvious to most people, as are the research and communications potential. We have had to recognize a changing set of needs among our primary stakeholders, including students and the businesses likely to employ them.

So we have tried to keep up and to change, while holding to the fundamentals of the Information Systems discipline. We have tried to be innovative in our methods of course delivery. We have faced many challenges and solved problems only to meet new challenges problems. The purpose of this paper is to discuss the issues we have faced walking along this path. In it, we will examine the problems faced by instructors of information technology when they try to introduce new technologies for delivering instructional material. We have extensive experience in utilizing innovative instructional technologies, and are well aware of the rewards and frustrations encountered on the leading edge.

BACKGROUND

The authors work at a state university, and have access to some advanced technologies. We have also, on our own, developed the use of a suite of applications, including web servers and ftp servers, and methodologies, such as delivering course materials over the World Wide Web. Our aim in trying to stay on the "leading edge" is to examine whether increased productivity can be expected from using new technologies. We would argue for an operative paradigm of shared decision-making. This approach can be a struggle, because in many institutions of higher learning and other organizations, an older model exists, in which managers who may have only a passing familiarity with new technologies make decisions about technology acquisitions and implementations. Most colleges and universities have administrative entities with titles such as "Academic Computing" and "Computer Services". These agencies generally administer the academic and administrative computers on the campus. While ostensibly service agencies, their purposes, decisions, and actions are often at odds with the needs of the innovative professor. These agencies can sometimes act as dictators of computing resources, thereby affecting technology-intensive curricula.

We argue in this paper that academic departments responsible for teaching technology-intensive curricula must have their own labs, under their direct control, in order to adequately present their courses. These departments are in a position directly analogous to science departments that require labs under their control to teach their curricula. Further, there must be a distinction made between production labs, which would be used for general day-to-day teaching, and experimental labs, which would be used for trying out new technologies without affecting the production labs.

As a final point of background, we will try to be careful to define what we mean when we use terms such as "leading edge", "innovative professors", and "technology-intensive curricula". We are using these terms in a narrow, specific way, and do not mean to imply that professors who do not use the same technologies, or who use other technologies in other ways, are not "innovative" or "leading edge". Fundamentally, we are talking about professors of Information Technology who, in some measure, try to eschew traditional methods of course delivery to incorporate technological delivery methods; we envision courses where the student not only cannot pass the course, but cannot perform many of the mundane aspects of the course without becoming intimately involved with the technology. Thus students do not receive paper syllabi; they must retrieve the syllabus from the Web. Thus, students never hand in assignments or tests on paper; all such submissions are handled electronically.

We have not struggled to create a taxonomy of issues to present in this paper. Rather, we have selected the ones that seem to us to be the most important, difficult, or challenging. The issues discussed include:

- Dealing with new versions of software, when the institution wants to keep older versions on all of its computers
- Dealing with budgets, both as constraints on resources and as inefficient mechanisms for providing leading edge technology
- Dealing with colleagues, staff, and students who are not always in synch with leading edge needs
- Conversely, we also have to deal with students whose own computers and software are sometimes ahead of our own
- Using innovative technologies to deliver course materials – the rewards and the pitfalls

DEALING WITH NEW VERSIONS OF SOFTWARE

It would be an interesting topic for other research to study which of the academic disciplines must deal with the most rapid changes in subject matter and course delivery materials. As Information Systems professors with over 40 years of combined experience, we believe a strong case could be made for our field as experiencing the most rapid change. Although the fundamental topic areas (e.g. computer concepts, database concepts, systems analysis and design, etc.) have been recognized and set into the curriculum for many years, the actual technologies used to implement these concepts in the real world have undergone numerous radical changes over the years.

When we first came to our present positions in the early 1990s, our department was using DOS applications such as WordPerfect 5.1, dBaseIIIPlus, and Lotus 2.2. No attempt was being made to recognize that the Windows environment was beginning to emerge as the predominant microcomputer interface. It was a struggle for us to teach programs such as dBase, which had a copyright date of 1986, and to call ourselves up-to-date. Some of our colleagues argued that it didn't matter which software one used to teach the database concept, as long as one taught the concept clearly. This type of argument made it difficult to accept the argument made by the same colleagues that it would be impossible to use the Windows environment to teach, because the students would have trouble following the mouse, and because there was no command line interface.

Eventually, through forceful argument and simple market forces, we moved to a Windows 3.1 environment in our labs and classrooms. However many faculty strongly resisted that move.

Our University administration made the decision to provide a "common desktop" of applications across the computers of all staff, faculty, students, labs, and classrooms. Like all simplistic solutions to complex problems, this "common desktop" had many attractions and benefits to the campus as a whole. For example, it was now easier for the Academic Computing and Computer Services areas to administer individual software packages across the campus computer network, provided that a standard package for each type of application had been agreed upon.

Unfortunately, this has sometimes had very negative impacts upon our ability to stay current in our delivery of our courses. As IS professors, we have an obligation to develop our understandings of the latest ideas in software. This is at odds with the University's need to protect its investment in current technologies. Since the University has imposed (with reasonable and benign intent, it should be said) the common desktop, our ability to deliver the latest important software to our students has been compromised. One current example should make this issue clear.

When we finally moved to Windows95, the University standardized on the Microsoft Office95 suite of products to meet our corporate needs for word processing, spreadsheet processing, and database applications not served by our mainframe. At the time, in 1996, this coincided well with the changes in our department's curriculum, and our department was among the strongest advocates for bringing about this change. Many factions on campus were dead-set against making this change, including the secretarial staff, who had years of WordPerfect experience and understandably resisted the change to Word. By the Fall of 1996, our department had several up-to-date labs and classrooms with the "latest" software.

In the Spring of 1997, Microsoft introduced the Office97 suite of applications, which promised much better integration with the Internet, and were attractive adjuncts to our curriculum. We have still not moved as a University to this upgraded version of Office over a year and a half later, and we are not likely to do so for another year. The reasons are unclear, but they seem to be that the Director of Academic Computing is afraid that too many people will resist the upgrade. This points up the way in which a department that is heavily dependent on utilizing modern technologies can have its curriculum held hostage by corporate inertia.

One of the practical results of the above situation is that we and our students have had to deal with several different versions of software, because many of our students moved quickly to Office97, as did the authors of this paper. Although annoying and unnecessary, this is not a huge problem, except when using a product such as Microsoft Access, where the latest version (Access97) is not backwards compatible (can't be saved as) an earlier version (e.g. Access95 or Access 2). Microsoft's confusing version numbers for the earlier version (i.e., Access95 is also called version 7) have not helped this situation.

DEALING WITH BUDGETS

This is a simple issue. At many institutions, the budgeting process does not work well to serve the needs of Information Systems departments. First, budgets are set at least a year in advance, which leaves technology-dependent departments with the impossible task of predicting their needs well over as year in advance. Often, this leads to a continuation of the familiar, the same. Little room is left in the budgeting process for innovation. When innovations are introduced, they are often budgeted only for an initial year, and no provision is made for ongoing, continuing expenses related to a particular innovation. This is not meant as an indictment of budgeting, nor of its practitioners. But there is a political and cultural difference between those who budget, who tend in that area of their lives to use conservative, sound fiscal practices based on past such practices, and academic innovators, who must remain open to changing winds within their fields; if we are correct that information technology fields change more rapidly than any other academic disciplines, then this leaves innovators within those fields as the ones most likely not to be adequately served by the budgeting process.

Fortunately, the news is not all gloomy on this front. Many organizations are starting to recognize the special needs of the technological innovator and are trying to accommodate. In our College of Business at our University, we have begun to recognize that some of our faculty are so experimental and innovative that their needs must be treated differently from the norm. We recognize these individuals by trying to upgrade their computers and software more often. And we expect them to keep innovating and experimenting.

DEALING WITH COLLEAGUES, STAFF, AND STUDENTS WHO ARE NOT ALWAYS IN SYNCH WITH LEADING EDGE NEEDS

We have touched in earlier sections on the tensions that exist between colleagues. Some of our colleagues in our own department argued against teaching using Windows because they felt it would be impossible. Many in the secretarial staff argued against changing word processors or spreadsheet programs because they already had an excellent command of WordPerfect and were convinced that Word lacked WordPerfect's capabilities and also that the learning curve would make many of them unproductive. The Accounting department, in particular, was heavily vested in using Lotus 1-2-3.

It has grown increasingly difficult to keep up with the pace of change in today's technologically driven world. Software companies have thus far demonstrated a remarkable capacity for marginal product upgrades that instill a need in consumers because of only one or two "killer features". The differences between the latest version of Microsoft Office (Office97 at the time of this writing) and Office two versions ago is actually very small. Almost any reasonably computer literate individual should be able to migrate from the earlier version to the later version and immediately have about 90% of the capability s/he had before upgrading. The other 10% will come very quickly, along with additional capabilities included in the new version. Thus upgrading from one version of software to another is generally no more daunting than learning to operate a new car. Yet people resist software upgrades.

In our field, this causes problems because there are compelling reasons for upgrading and always staying current. We list several below:

- Our students tend to stay current, either because they buy new computers with the latest software before entering college, or because they have a natural sense of what will be expected of them in college or their future workplaces and don't want to be left behind.

- Upgrading tends to standardize everyone at the same level, whereas not upgrading ensures that there will be a lack of standardization.

- Upgrading makes new "killer features" available. There are enough valuable features added into Office97 that did not exist in Office95 to make the argument that we should have upgraded over a year ago. By not upgrading, our students have been confused by different versions, and have either been denied these new capabilities, or have had to learn them on their own at their own expense.

Of course, the argument against immediate upgrading is that there are bound to be bugs in the new software. There is some truth to this argument, but since there are bugs in the old software, and there are always problems with computers, we feel that this argument does not have much force. We would argue that a department such as ours should never be more than one semester behind the introduction of a significant upgrade to a software product important to our curriculum.

DEALING WITH STUDENTS WHOSE OWN COMPUTERS AND SOFTWARE ARE SOMETIMES AHEAD OF OUR OWN

While this can be a very positive circumstance, it is often frustrating to have to deal with students who own later versions of software than those available on our university systems. This is not because we don't want students to utilize current technologies (see our feelings above), but because the different versions of software can cause incompatibilities and confusions among students and professors.

Students using newer versions of Office97 have already grown used to some of the newer convenient features (e.g. the Paste Function button in Excel, or the customizable toolbars of Office97, or the Visual BASIC for applications found in all Office97 products); it is hard to have to go back to less convenient ways of doing things found in earlier versions. Sometimes students have submitted assignments unknowingly in later versions of software formats, and professors who only have access to earlier versions are unable to read the assignments. Both authors of this paper have had to install, at their own expense, simultaneous versions of Office95 and Office97 in order to handle this type of situation.

Students also rightly feel that their professors should generally be more knowledgeable than most students about changes to important software packages. Not keeping up with the latest software can make a professor seem uninformed and ill equipped to teach, especially if the students are more current than the professor.

USING INNOVATIVE TECHNOLOGIES TO DELIVER COURSE MATERIALS

In this section we detail several of the techniques we have developed for weaving technology into the fabric of our courses. Techniques discussed include using the World Wide Web and ftp.

The World Wide Web – Online Syllabi

For each course we teach, we create a home page on our Web servers to which we create a link from our individual home pages. Each course home page consists of an HTML frame that has a list of options displayed on the left-hand area of the screen with the corresponding selection appearing to the right. The options usually include 1) a return to the professor's home page, 2) the course description, and 3) the course syllabus. Thus, if the student picks the course syllabus, the syllabus will be displayed in the right two-thirds of the screen.

The first day of each class, students are instructed to go to a computer lab, get into Netscape, and go to the instructor's home page. From there, students are shown how to find the appropriate course syllabus. Since no paper syllabus is handed out, students must use this resource. From the first day of classes, students are actively engaged in actually using the technology we are trying to teach them; the technology comes at them not only in the form of assignments, but also in the natural course of being students in our courses trying to get information about the courses.

This technique requires some knowledge of how to set up a web server, and of HTML. In our cases, since we each run our own web servers, it requires us to run our office machines 24 hours a day, seven days a week. If the machines are unreliable, which has occasionally happened, this will not work. It has also happened that a student working for Academic Computing came into one of the author's office uninvited and installed software that caused the author's computer to crash regularly each night.

FTP – Delivering Assignments

Similarly, when students have assignments or papers to hand in, they no longer hand in disks nor hard copy. All work is handed in electronically over the campus TCP/IP system using the File Transfer Protocol (ftp). FTP is a service that allows files to be copied from on machine to another over a TCP/IP network, such as the Internet.

Each of the authors has set up an ftp server on his office machine, which runs 24 hours a day under normal circumstances. The FTP server software chosen is called Serv-U, which is a shareware package; for a fee of about $20.00, one can get a very robust FTP server with an easy to understand interface. Using client ftp software available in all computer labs and in almost all home Internet setups, students can transmit their files at any time to the instructor's machine, using accounts set up specifically for each assignment.

Each account designates the course, the assignment, and the appropriate subdirectory for the assignment, so each assignment ends up exactly where we want it on our hard drives, ready to be graded. We have hit upon a system for creating User IDs and passwords for each assignment that has worked well for us. For example, if the course is 92.150 (Introduction to CIS) and the assignment is the first Excel assignment, the User ID would be 92.150.excel1. The password for the account is always the same as whatever comes after the last period in the User ID, therefore the password in this case would be excel1. Creating the account lists by assignment, rather than by individual student, saves us a lot of time and effort. However, it does mean that the students must have a system for naming their files, because duplicate filenames cannot exist. Our system is to require students to name the files they submit by their last names and assignment number. Under this system, Carl Chimi's first Excel assignment file would be called chimi1.xls. In the event of duplicate last names, the initial of the first name, or some other convenient discriminator, is used, e.g. chimic1.xls (Carl Chimi) and chimij1.xls (Jeanine Chimi).

Also, if a student submits a file, but then wishes to revise it, s/he must rename the revised file using a letter, e.g. chimic1b.xls. Only the latest version of the file is used for grading purposes.

Accounts are turned off at the designated due time, so late submissions are not possible through ftp. This system has many advantages, not the least of which is that, if performed correctly, it forces the student to have a backup copy of his or her assignment. We know of colleagues who encourage file submissions via attachments to email messages, and we teach this technique in classes where it is appropriate, but we feel that the FTP method is superior for general assignment delivery, because it puts the files right in the subdirectories on our hard drives where they belong. Email attachments have to be unattached and manually placed where they belong.

The World Wide Web – Online Exams

Examinations are rarely given on paper in our classes anymore. For each exam, an electronic template is created using a shareware product called Webforms. This automatically sets up an HTML copy of the exam but, more importantly, Webforms also contains functions for collecting the data for each student's exam into a Microsoft Access database, whence it can easily be graded. While this process can be time consuming on the front end for the instructor, it has many advantages. The important point is that students have to use the technology in order to take the exam (and they all learn to do it very quickly because they have to).

Webforms, like Serv-U, is a shareware package requiring a nominal registration fee (about $30.00). The interface can be a little tricky, but a familiarity with creating forms in HTML will make it easier to work with. Using Webforms, one creates the basic structure of the exam, i.e. all of the fields to be filled in (e.g. name and student number, text areas for essay questions, radio buttons for True/False or Multiple Choice questions), text to be displayed (questions, instructions, etc.), email address where the exam answers are to be sent, and submission and reset buttons. Once the structure is complete, Webforms will automatically generate the proper HTML code for the exam. Our experience is that Webforms, while very good, will not generate a completely useable HTML test; usually another HTML editor such as Netscape Communicator or the Windows Notepad is used to finalize the look of the exam.

The HTML exam file is placed on a University server that runs a World Wide Web server. At exam time, the students are given the URL for the exam and instructed to use Netscape to locate it. The students are also instructed (usually during the class period before the first exam) that their answers will be sent to the instructor in the form of an email message and that, therefore, each student must know how to set up Netscape to send email. Learning this procedure is considered to be part of the test; students are told that they must know it when they take the exam, no instruction in setting up Netscape will be given on exam day. Very few students come unprepared.

When a student is finished with the exam, s/he presses a Submit button, which sends the exam answers as an email message to the instructor's email account on a University UNIX server. The instructor monitors the server, and as each exam arrives, that student is notified. At that point the student is free to close Netscape and to leave. Students should not close the exam until they know for certain that the exam has arrived in the instructor's account. Students are also free to print their exams, if they desire.

Once all of the exams have arrived in the instructor's email account, Webforms comes into play again. The professional edition of Webforms allows the user to designate a POP3 mail server (such as the UNIX mail server mentioned above). Webforms will then go out to that server, examine all of the email messages found on it, and download each message which was generated by a file (such as the HTML exam) generated by Webforms. Essentially, it downloads each exam into its internal database. Form there, Webforms can export the data out to either a text file or a Microsoft Access database with each question in its own field.

With the data in Access, it is easy to automate the grading of True/False and Multiple Choice questions; essay questions must, of course, still be graded manually. The grades are recorded in an Excel spreadsheet and pasted onto an article posted to the class newsgroup, discussed below.

Students seem to really prefer this method of taking exams to using pen and paper, and they have been vocal in their preference. Somehow, once they are used to taking exams this way, the process seems to flow very quickly and smoothly. As instructors, we generally prefer to give exams this way now, but we warn our readers that there is more work involved, especially on the front end, in giving tests this way. The learning curve is substantial, but not insuperable, and the whole process is more complex than just printing and duplicating an exam. Having a knowledgeable graduate assistant who can do some of the grunt work involved can ease some of the pain involved, as can the knowledge that your students are doing the very things you want them to learn in order to do something as mundane as taking a test.

CONCLUSION

While the authors do not have solutions to all of the problems to be presented, it is hoped that the discussions engendered by our paper will lead to a cross-fertilization of ideas between institutions. We envision this paper as the beginning of a dialogue among people who want to be innovative, but to be so in an informed and aware manner.

MIGRATING COBOL-BASED DEVELOPERS INTO OO DEVELOPMENT USING EXAMPLES IN OO COBOL AND JAVA

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COBOL-based legacy systems continue to dominate the enterprise-wide systems of larger organizations in the corporate world. New COBOL code (2-5 billion lines) continues to be added each year along with billions of dollars invested to fix the year 2000 problem. Some organizations are migrating legacy systems into newer solutions using various enterprise resource planning (ERP) models. These models use tools from companies such as SAP, Baan, Peoplesoft, Oracle, and Sterling Software. Many organizations will continue to maintain their legacy based backends while slowly evolving to GUI front ends, client-based reporting and data warehousing applications that extract data from the legacy systems. Some of this legacy base will slowly evolve toward an object oriented development environment using languages such as OO-COBOL and Java. This development transition will require the retraining of large numbers of COBOL-based developers (a subset of the estimated 600,000 COBOL-based developers) into an object oriented development environment. This paper illustrates an approach to assist the migration of COBOL-based developers into the object oriented development world. Simple object examples based on an information systems application scenario have been designed and programmed using both OO-COBOL and Java. The objectives of the examples are to help the COBOL-based developer learn some of the basic principles of objects by using a familiar language, and to help them make the transition to other object oriented languages that may be used in enterprise systems development.

INTRODUCTION

The enterprise-wide systems of larger organizations continue to be heavily dependent on legacy based platforms that include COBOL, IMS, IDMS, CICS, DB2, Oracle, and MVS. Some of these organizations have changed the database platforms to Oracle and DB2, phasing out IMS and IDMS. Some work has been done to phase out block mode 3270 screens, and replace them with GUI front ends. Some organizations (typically smaller organizations) have phased out their COBOL legacy systems totally using tools like Powerbuilder, Visual Basic, and Oracle Tools along with DB2 and Oracle for the database platforms. Other organizations are building new systems using Enterprise Resource Planning tools from companies such as Peoplesoft, SAP, Baan, Oracle and Sterling Software. Some of these approaches require the organization to reengineer their business processes to fit the business models embedded in the tool. There are a large number of organizations that have no current plans to phase out their COBOL-based systems. Some of the reasons include, heavy investments in the existing systems including Y2K investments, complexity of reengineering existing systems, cost of new technology retraining and the inability of some of the newer technology platforms to scale up to the performance levels required.

The COBOL-based legacy systems represent a major portion of the processing done in larger organizations. Estimates put the lines of COBOL code in the 200 billion range with 2-5 billion lines of new development added each year. It is estimated that the number of COBOL-based developers is in the 600,000 range.

One transition strategy will be to phase COBOL-based legacy systems into object oriented or component based systems. One of the problems in doing this will be the training required to transition COBOL-based developers into object oriented developers. If we can come up with ways to train a portion of the COBOL base of developers into object oriented developers, it will make it easier to phase these systems into object-based systems. This paper illustrates an approach of using OO COBOL with a simple application to demonstrate some of the fundamental concepts involved in OO development. The intent is that it will be easier for the COBOL developer to follow the implementation concepts in a familiar language. We go on to show the same application implemented in Java using the same design which makes is fairly easy for the COBOL developer to follow the Java implementation.

APPLICATION DESCRIPTION AND ANALYSIS

Our sample application is an abstraction from a small regional airline called AirWest. This application takes the perspective of the operations person responsible for scheduling aircraft for flights. The operations person uses capacity of the airplane, airplane speed, and airplane size to schedule aircraft. An airplane's size is important since AirWest lands at many smaller regional airports. Many of these regional airports do not have gateways for loading and unloading passengers and therefore, can only accommodate small planes.

In order for the COBOL developer to understand the object approach used in solving the AirWest problem, several classes covering basic object terminology and concepts should be taken. It is also very helpful if the developer is presented with an object development methodology. Our approach is to provide a CBT course on object concepts, a manual and CBT on the Rational Systems Objectory methodology, and then walk the developer through a summary of the Objectory analysis and design processes for AirWest followed by implementation. The following sections briefly cover the analysis and design pertaining to AirWest for this small problem.

Application Analysis

Our analysis consists of "Use-Case Analysis" and "Object Analysis". In most systems an "Architectural Analysis" would be necessary, but since our example is quite limited in scope no architectural analysis is needed. During Use-case Analysis, use-cases are constructed that describe the behavior of our system. These detailed descriptions form a basis from which to extract classes. Classes will be identified as boundary, entity, or control type classes. These class types are briefly described in Figure 1.

FIGURE 1
OBJECT CLASS TYPES

Class Type	Description
Boundary	A boundary class models the interaction between the system's surroundings and its inner workings These classes are therefore dependent on the surroundings.
Control	A control class is a class used to model control behavior specific to one or a few use cases. Control classes control other objects.
Entity	An entity class is a class used to model information and associated behavior that must be stored. Entity objects are used to hold and update information.

In Object Analysis the exact responsibility of each class is defined. During this evaluation of each class, a discovery of aggregation, generalization and associations between classes occurs.

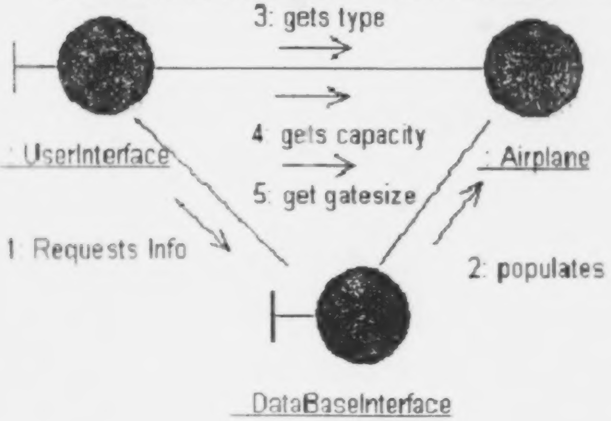
Use-Case Analysis. Our use-case defines operations personnel that do airplane assignment from scheduling information. There are three types of information that the operations person needs for scheduling. Different routes have a heavier passenger load, so the airplane capacity is critical to ensure enough flight availability for customers. Aircraft size is important since different airports have different gate facilities. AirWest rates airplanes for gates with a "Sml", "Med", and "Lg" size designation. Finally, the speed of the aircraft is important to determine estimated flight time.

This application has been simplified significantly to focus on the object-oriented concepts. Data normally stored in a database has been simulated with static tables in a DataBaseInterface object to eliminate the complexity of linking to a database. The user interface uses a command line interface eliminating the need for implementing GUI code.

Given these simplifying assumptions our analysis proceeds with identifying the objects. The scheduler requests the information for a list of airplanes that are displayed on the screen using the beginning and ending airplane numbers. We will call this boundary type object the UserInterface.

Another object identified in our use-case is the airplane object. It is evident that airplane data must be persistent and stored for retrieval. An airplane is an example of an entity type object that contains information. Evaluating this scenario further, several objects are defined including the Airplane, UserInterface, and the DataBaseInterface. Our next step is to determine how our newly discovered objects interact by walking through a scenario of events in our use-case. The collaboration diagram in Figure 2 shows the objects and the sequence of events necessary to generate the list for our operations person. The collaboration diagram provides the first iteration at understanding how the objects are associated with each other. This collaboration provides the base of what will later become the specific methods supported by each class.

FIGURE 2
COLLABORATION DIAGRAM FOR AIRWEST



Our scenario indicates that the UserInterface object will (1) request information from the DataBaseInterface. In turn, the DataBaseInterface object will (2) create and populate an appropriate Airplane object. The UserInterface can then make (3,4,5) calls on the Airplane object to retrieve its attributes. Given the use-case analysis and a preliminary definition of our classes, we can proceed with Object Analysis.

Object Analysis. During "Object Analysis" an attempt is made to bring clarity to our object and corresponding class definitions. Specifically, objects are evaluated as candidates for aggregation or generalization. Aggregation is when one object is part of another. For example, a wheel on a bicycle represents a part of the whole. Generalization is when a higher order object represents characteristics and behavior that applies to a general group of more specific objects. For example, Labrador Retrievers and German Shepherds are both members of the dog family.

Looking at the AirWest application, one of the issues for the operations scheduler is the speed of the airplane. AirWest has only two types of planes; Jets and Turbo Prop. This presents the possibility of a generalization. All airplanes have an airplane number and a type designation. However, Jets and Turbo Props fly at different speeds, have different internal seat configurations and passenger capacity, and require different terminal equipment at the gate for loading and unloading. Therefore, an Airplane class could have two subclasses; Jet and Turbo. This means that Jet and Turbo will be derived from Airplane and will inherit the Airplane characteristics.

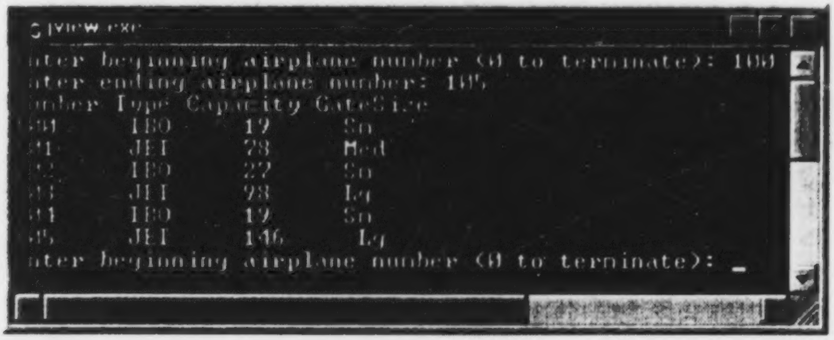
After adding our new subclasses the class diagram has five classes, UserInterface, DataBaseInterface, Airplane, Jet and Turbo. UserInterface and DataBaseInterface are boundary classes and Airplane, Jet and Turbo are entity type classes. The collaboration diagram will be updated for our two derived classes Jet and Turbo. This will be done in design when the object interaction sequence diagram is developed. Events or messages on the collaboration diagram will translate into method calls during object design.

Application Design

During the design process another iteration is made through Use-cases and class diagrams developed from the analysis. Some new diagrams are added to understand the exact nature of the interaction between objects.

Use-Case Design. All logic for the user interface will be represented in the UserInterface class. The user will enter a range of airplane numbers and a table with airplane number, type, capacity, and gate size requirements will be displayed. The interface will appear to the user as shown in Figure 3.

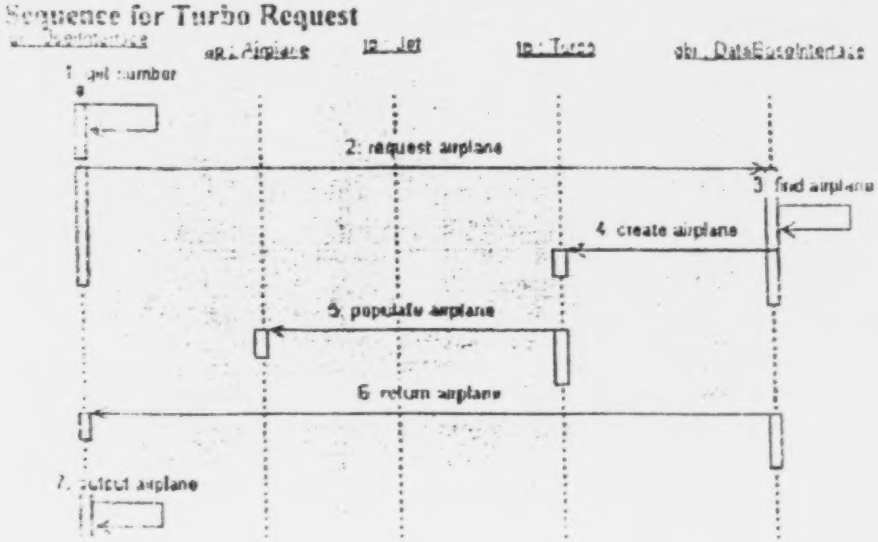
FIGURE 3
USER INTERFACE FOR AIRWEST



```
nter beginning airplane number (0 to terminate): 100
nter ending airplane number: 105
umber Type Capacity GateSize
00     TBO     19      Sm
01     JET     78      Med
02     TBO     27      Sm
03     JET     98      Lg
04     TBO     19      Sm
05     JET     146      Lg
nter beginning airplane number (0 to terminate): _
```

From our analysis the collaboration diagram started to establish the sequence of messages between objects. Remember that our object analysis discovered the generalization Airplane and its subclasses: Jet and Turbo. We will need to include these in our sequence diagram. A sequence diagram shown in Figure 4 is based on a user query for planes. In construction of the sequence or interaction diagram all objects are represented by vertical dotted lines and messages on shown as horizontal lines. The operations person requests a range of plane numbers. This request is forwarded to the DataBaseInterface object to locate the data and create a populated Turbo or Jet object. A reference to the Turbo or Jet object is passed back to the UserInterface object and displayed.

FIGURE 4
SEQUENCE DIAGRAM



Sequence for Turbo Request
: UserInterface
: Airplane
: Jet
: Turbo
: DataBaseInterface
1: get number
2: request airplane
3: find airplane
4: create airplane
5: populate airplane
6: return airplane
7: select airplane

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The sequence diagram is used as a starting point to develop method names associated with the messages or calls shown on the diagram.

Object Design. Taking the new method information we can start to complete the classes from which the objects are derived. We need to consider what attributes will be required to support our objects. Attributes are derived from the sequence of events; the user enters an airplane number, a call to the database interface object is required to get our Airplane, and create the Airplane object with a return reference to the object. Recall from our analysis we determined that Airplane was an abstract class that never gets instantiated by itself. Rather, one of the subclasses Jet or Turbo, is created for a specific type of airplane. The Airplane class contains common attributes for airplane number, airplane gatesize and airplane type. Each subclass contains different information so that the capacity of the airplane can be determined. The attributes required for capacity are given in Figure 5.

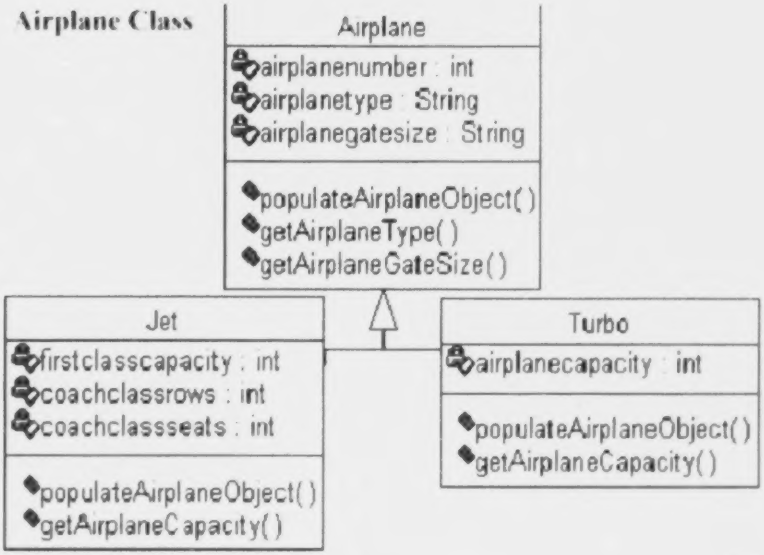
FIGURE 5
CAPACITY ATTRIBUTES

Class	**Attributes**	**Capacity Equation**
Jet	firstclasscapacity coachclassrows coachclassseats	firstclasscapacity + (coachclassrows * coachclassseats)
Turbo	airplanecapacity	airplanecapacity

The resulting airplane class diagram is shown in Figure 6. Attributes are shown on the top of each class and the methods defining class behavior are indicated at the bottom of each class.

Our class structure is almost complete, but in order to test the classes and launch the application, a control class is needed. A control type class is added called "Airplane Driver". This class is used only for testing. It contains one method that creates and calls the UserInterface to test the application.

FIGURE 6
AIRPLANE CLASS DIAGRAM


Airplane Class
Airplane
airplanenumber : int
airplanetype : String
airplanegatesize : String
populateAirplaneObject()
getAirplaneType()
getAirplaneGateSize()
Jet
firstclasscapacity : int
coachclassrows : int
coachclassseats : int
populateAirplaneObject()
getAirplaneCapacity()
Turbo
airplanecapacity : int
populateAirplaneObject()
getAirplaneCapacity()

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Implementation in OO COBOL

Introduction and OO COBOL Overview

The main hurdles in making the transition from procedural programming to OO programming are 1) understanding what an object consists of, 2) understanding how objects communicate with each other, and 3) managing the information required by developers to maintain and access objects. Program design and implementation in OO programming can vary just like it varies in procedural programming. Implementation can also be influenced some by the language since different languages have different features.

Implementation of OO COBOL (COBOL 2000) does not add many syntax additions to COBOL. Consequently, syntax is a minor issue for the COBOL developer to go from procedural COBOL to OO COBOL. The following is quick overview of some of the changes and related concepts. A CLASS is similar to a template or framework. It is the description of an object, which includes a description of the object data and the various procedures (methods) that can access that object data. A class program has a Class-id instead of a Program-id as shown in the following example.

```
Identification Division.
Class-id.  airPlaneClass   inherits from Base.
```

A class is used to create an object. Each time an instance of an object is created in memory it takes on all the characteristics that were defined by the class. The instance is called an 'object' and the description of the object is called a 'class'. The class name is the logical name that is used when we create a new instance of the object. The logical name has to be connected to an external physical file name, so the program creating the instance of the object knows where to find the definitions. This is similar to associating logic data file names in a COBOL program to physical files. In the following example, 'airPlaneClass' is the logical class name and 'airplane' is the executable.

```
Environment Division.
 Object Section.
 Class-Control.
   airPlaneClass is class "airplane"
   Base          is class "base".
```

The class definitions for an object include the object data definitions and the procedural code for each method. A method is a small program that is similar to a subprogram or procedure. It is called from other procedures and it can accept data and return data to the calling procedure. The description of an object starts with the keyword 'Object'.

```
OBJECT.
Data Division.
Object-Storage Section.    *> OBJECT DATA
  01 airplane-data.
     10  airplane-number       pic 9(03).
     10  airplane-type         pic X(03).
     10  required-gate-size    pic X(03).
```

The object data is described within the Object-Storage section under the Data Division. The object data has object scope and is accessible to all methods within the same class. The methods are put in the Procedure Division that follow the Data Division just like any COBOL program. Note that the Class definition has one Data Division and one Procedure Division. Each Method definition has its own Data Division and Procedure Division. Methods are like a number of complete small programs within the overall class definition. The Method-id is like the program-id. The method ID (name) is used when calling this method from other methods. The linkage section is the common communication area between sub programs (methods). The procedure division statement specifies the incoming and outgoing parameter names. The keyword 'Using' is used for incoming data and 'Returning' is used for outgoing data. The parameter names are not sensitive, but the data types, and parameter sequence much match the calling statement exactly. The following example grabs the data for airplane type from the object storage area and returns it to the calling method.

```
Procedure Division.
Method-id. "get-airplane-type".
    Data Division.
    Linkage Section.
        01  ls-airplane-type  pic X(03).
    Procedure Division Returning ls-airplane-type.
        Move airplane-type to ls-airplane-type.
    End Method "get-airplane-type".
```

There can be any number of methods starting with 'Method-id' and ending with 'End Method' described under the Procedure Division. The statements 'End Object' and 'End Class' follow the last method description in the class program.

```
END OBJECT.
END CLASS airplaneClass.
```

The code used within a method is the same as any COBOL program with the exception of references to classes and methods. References to objects are done with the keyword 'Invoke' instead of using 'Call' as we do with subprograms. The statement to create an instance of an object is:

```
Invoke airpluser "New" Returning theUIHandle
```

'Airpluser' is the class name of the class that contains the description of the object. 'New' is a method in the Base class library that has the code to set up an object in memory. 'theUIHandle' is an object reference (binary) data item that contains a pointer to the specific instance of the object in memory that we created. A handle is set up in working storage or the linkage section of a program or method as:

```
        01 theUIHandle  object reference.
```

Once an object is created, the handle can be used to reference methods in that object by invoking the handle and specifying the name of the method. Data is sent to the method via the 'Using' parameter, and data is returned via the 'Returning' parameter. The following examples demonstrate the use of two different objects. In the first example, we are starting the process-airplane-data method in the user interface object that we created. It handles the user interface and control logic for this application. The second example uses the database interface object to read a record from the database that contains the data for the airplane number we pass to it. A handle is returned that contains the pointer reference to the airplane object in memory for that specific airplane.

```
Invoke theUIHandle "process-airplane-data"
Invoke theDBIHandle "read-airplane-record"
    Using airplane-number   Returning airplaneHandle
```

Inheritance

Our example developed as part of our OO COBOL/Java comparison includes an example of inheritance and polymorphism. The airplane class is a super class that contains two sub classes: Turbo and Jet. Both the Turbo and Jet classes inherit from the Airplane class. When a Turbo object is created, it sets up an area for object data that contains the data definitions from both the airplane class and the turbo class. See the examples below that came from the object –storage sections of each class. Airplane number, type and required gate size are common to both the Turbo and Jet. If a Turbo instance is created it will contain the airplane data and the airplane capacity. If a Jet instance is created it will contain the airplane data and the first class capacity, the number of rows and the number of seats per row in coach.

Methods defined in both the Airplane and Turbo classes can be used to access the object data in the Turbo instance. Using the example that follows in Airplane class and Turbo class, data is sent to the turbo class method 'populate-the-airplane-object' from the DBI where the data has been found for a specific airplane number. The populate method in the Turbo class populates the object data with the Turbo specific data, and calls on the method in the airplane class (super class) to populate the remaining airplane data. Notice that both methods use the same name (populate-the-airplane-object) but are distinguished with the key word 'Super'. These examples demonstrate some of the concepts of using inheritance to define data and procedures once and use these definitions in other classes. The following full listings of the Airplane and Turbo classes so they can be compared to the Java examples.

```
OBJECT. *>Object data definitions for Airplane Class
    Data Division.
    Object-Storage Section. *> OBJECT DATA
    01 airplane-data.
        10  airplane-number                pic 9(03).
        10  airplane-type                  pic X(03).
            10  required-gate-size         pic X(03).

OBJECT. *>  Object data definitions for Jet Class
    Data Division.
        Object-Storage Section. *> OBJECT DATA
            01 airplane-data.
                10  first-class-capacity  pic 9(02).
                10  coach-class-rows      pic 9(02).
            10  coach-class-seats         pic 9(02).

OBJECT. *>  Object data definitions for Turbo Class
    Data Division.
        Object-Storage Section.   *> OBJECT DATA
```

```
            01 airplane-data.
            10  airplane-capacity            pic 9(03).
```

Full COBOL Listing - Airplane Class

```
Identification Division.
    Class-id. airPlaneClass inherits from Base.
Environment Division.
    Object Section.
    Class-Control.
        airPlaneClass is class "airplane"
            Base is class "base".
OBJECT.
    Data Division.
    object-Storage Section. *> OBJECT DATA
    01 airplane-data.
        10 airplane-number          pic 9(03).
        10 airplane-type            pic x(03).
        10 required-gate-size       pic x(03).

Procedure Division.
Method-id. "get-airplane-type".
    Data Division.
        Linkage Section.
            01 ls-airplane-type         pic x(03).
    Procedure Division Returning ls-airplane-type.
        Move airplane-type to ls-airplane-type.
End Method "get-airplane-type".

Method-id. "get-airplane-gate-size".
    Data Division.
        Linkage Section.
            01 ls-required-gate-size  pic x(03).
    Procedure Division Returning ls-required-gate-size.
        Move required-gate-size to ls-required-gate-size.
End Method "get-airplane-gate-size".

Method-id. "populate-the-airplane-object". *> Used by Subclass
    Data Division.
        Linkage Section.
            01 ls-airplane-data         pic x(09).
    Procedure Division Using ls-airplane-data.
        Move ls-airplane-data to airplane-data.
End Method "populate-the-airplane-object".
END OBJECT.
END CLASS airplaneClass.
```

Full COBOL Listing - Turbo class

```
    Identification Division.
      Class-id.  turboClass inherits from airplaneClass.

    Environment Division.
      Object Section.
      Class-Control.
        airplaneClass is class "airplane"
        turboClass is class "turbo".
OBJECT.
   Data Division.
      Object-Storage Section.   *> OBJECT DATA
        01 airplane-data.
           10  airplane-capacity          pic 9(03).

Procedure Division.  *> Turbo Class Methods Follow
  Method-id. "get-airplane-capacity".
      Data Division.
       Linkage Section.
        01  ls-airplane-capacity          pic 9(03).
```

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```
   Procedure Division Returning ls-airplane-capacity.
      Move airplane-capacity to ls-airplane-capacity.
End Method "get-airplane-capacity".

Method-id. "populate-the-airplane-object".
   Data Division.
   Working-Storage Section.
    01 airplane-data.
        10  airplane-number          pic 9(03).
        10  airplane-type            pic X(03).
        10  required-gate-size       pic X(03).
   Linkage Section.
    01 ls-airplane-data.
        10  ls-airplane-number       pic 9(03).
        10  ls-airplane-type         pic X(03).
        10  ls-airplane-capacity     pic 9(02).
        10  ls-required-gate-size    pic X(03).
   Procedure Division Using ls-airplane-data.
  *> First populate the turbo airplane object
     Move ls-airplane-capacity to airplane-capacity
  *> Next populate the airplane object
     Move ls-airplane-number  to airplane-number
     Move ls-airplane-type to airplane-type
     Move ls-required-gate-size to required-gate-size
  *> Use the method in the Airplane Class (Super)
     Invoke Super "populate-the-airplane-object"
             Using airplane-data.
  End Method "populate-the-airplane-object".
  END OBJECT.
  END CLASS turboClass.
```

Polymorphism

Our AirWest illustration also covers the concept of polymorphism. Each airplane instance that is created is either a Jet or a Turbo. The handle to the object, regardless if it is Turbo or Jet, is the same name. A statement in the control logic that asks the object to return the capacity will return the correct capacity even though the calculation of capacity is different for a Jet or a Turbo. The invoke in the control program to obtain the capacity is shown as follows:

```
Invoke airplaneHandle "get-airplane-capacity"
Returning airplane-capacity
```

The method that is used depends on the object instance that was created. The same method name is used, but different code is executed depending on the object instance in memory. This is the concept of polymorphism. It the object instance is a jet plane, the following jet class method is used to calculate and return capacity.

```
Method-id. "get-airplane-capacity".  *> Jet Class
    Data Division.
        Linkage Section.
            1.  ls-airplane-capacity   pic 9(03).
        Procedure Division Returning ls-airplane-
        capacity.
```

```
               Compute   ls-airplane-capacity   =
               first-class-capacity
                       +    coach-class-rows     *
                       coach-class-seats.
End Method "get-airplane-capacity".
```

If the object instance is a Turbo plane, the capacity is part of the object data and returned without any computations necessary. This is shown in the 'get-airplane-capacity' method in the Turbo class listing above.

IMPLEMENTATION IN JAVA

Introduction and Overview of Java

The implementation of the application in Java was done to parallel the design and implementation in OO COBOL. The Java implementation has all of the same components that include a driver, a user interface, a database interface and an airplane class with two subclasses, Jet and Turbo. The functionality of each component is the same. To the degree possible, the same data names, types, class names and method names in both implementations. Java was designed as an OO language from the beginning and is less wordy in its implementation. It also is a little more cryptic and relies on bracketed structures instead of END scope terminators that are used in COBOL.

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The Class is named in the first line of a source file with the statement:

```
        public abstract class Airplane { }
```

The open bracket identifies the beginning of the class definition and a close bracket ends it. The scope declaration "public" indicates that objects created from this class are visible to all other objects in the application. The key word "abstract" indicates that this class will not be instantiated directly and forms a superclass for subordinate classes. Recall our previous examples, the subordinate classes are Jet and Turbo. Airplane is the class name and is used as a data type to declare object references. Unlike COBOL Java source files are compiled into bytecode classes that are executed by the Java runtime. A bytecode class file bears the same name as the class and includes a "class" file extension. So the file name for the Airplane class would appear as "Airplane.class".

Data definitions for objects instantiated from the class follow the class name just as they do in OO COBOL. The definitions are more similar to Basic and C, using data types of String, integer and float. In this case, the data type String, is-another class which is defined in the standard Java class hierarchy. So, airplanetype is actually a reference to an object of type String. Size of the int variables is defined to be a four byte binary integer.

```
// object data definitions - Airplane Class
int airplanenumber;
String airplanetype;
String airplanegatesize;

//Object Data Definitions - Jet Class
int firstclasscapacity;
int coachclassrows;
int coachclassseats;

// Object Data Definitions - Turbo Class
int airplanecapacity;
```

Methods follow the object data definition just like in COBOL, but they are much shorter because there is very little in the way of data definitions within the methods. Object data is accessed directly by specifying the variable name without a linkage section used in COBOL.

The method 'getAirplaneType' in the airplane class is set up as public String meaning it returns an object reference to type String. No incoming parameters are defined. It will return the String object reference that contains the airplane type within the current instance of the Airplane object.

```
// fetchs the airplane type
public String getAirplaneType() {
        return airplanetype;
}
```

The statement to create a new instance of an object is: ui = new Userinterface(); This is very similar to OO COBOL. ui becomes the object reference or handle to the object created from the class Userinterface. 'New' is the same keyword to specify creating a new instance of the object. Userinterface() is a call to the constructor for the class Userinterface. Unlike COBOL this constructor could have arguments passed as a part of the object creation call.

Inheritance

Recall that our Airplane class in Java was defined with the keyword abstract. This meant that an object of type Airplane could not be instantiated. Rather only instances of subclasses of Airplane may exist. This is the normal definition of inheritance where both Jet and Turbo, subclasses of Airplane, inherit the data from Airplane as well as any behavior defined in Airplane's methods.

When a Jet object is created the resulting object contains the following data from both classes.

```
   // object data definitions from the Airplane
   Class
   int airplanenumber;
   String airplanetype;
   String airplanegatesize;
   //object data definitions from the Jet Class

int firstclasscapacity;
int coachclassrows;
int coachclassseats;
```

Any of the object variables can be accessed from methods in the Jet Class, however only object variables from Airplane are available to methods in the Airplane class. All methods belonging to Airplane or Jet may be accessed from a Jet object reference. Java resolves object method calls by looking first within the current class, and if the method is not found, walking progressively up any superclasses that exist.

Full Java Listing - Airplane class

```
public abstract class Airplane {
   // object data definitions
      int airplanenumber;
      String airplanetype;
      String airplanegatesize;

   // fetchs the airplane type
      public String getAirplaneType() {
         return airplanetype;
```

```
    }
  // fetchs the airplane gate size
    public String getAirplaneGateSize() {
      return airplanegatesize;
    }
  // this method is called from the subclass to
  populate the
  // instance variables
    public    void    populateAirplaneObject(int
    number, String type,
      String size) {
      airplanenumber = number;
      airplanetype = type;
      airplanegatesize = size;
    }
  // the abstract method for capacity must exist
  in any
  // subclasses extended from Airplane
    abstract int getAirplaneCapacity();
}
```

Full Java Listing - Turbo class

```
public class Turbo extends Airplane {
  // Object Data Definitions
  int airplanecapacity;

  public int getAirplaneCapacity() {
    return airplanecapacity;
  }
  //   the   populate   is   called   from   the
  DataBaseInterface object
  // when the object is first created
  public void populateAirplaneObject(int number,
  String type,
  String size, int capacity) {
  airplanecapacity = capacity;
  super.populateAirplaneObject(number,     type,
  size);
  }
}
```

Polymorphism

The use of an abstract class like Airplane allows implementation of polymorphic behavior. In Java any subclass object can be referenced through a reference to the superclass. Therefore, a reference to Airplane can contain an actual reference to either a Jet for Turbo object. Java does runtime resolution of method invocation so the methods for the correct object are called.

In the UserInterface object for our application a reference to Airplane is defined. Depending on which actual object, Jet or Turbo, is retrieved from the databaseinterface, the appropriate methods are called to display airplane type, capacity, and gate size.

SUMMARY

The approach that we have taken provides a migration strategy to move COBOL based developers to an object paradigm. The approach is to 1) provide some object oriented training, 2) apply the object concepts through the analysis and design of a small application, 3) implement the design using OO COBOL, 4) give them a parallel solution that has been implemented in a pure OO language using Java, and 5) compare and contrast the implementations. This gradual transition strategy allows the COBOL developer to learn object-oriented development without moving directly to a new language.

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A HIERARCHY FUZZY MCDM METHOD FOR STUDYING ELECTRONIC MARKETING STRATEGIES IN THE INFORMATION SERVICE INDUSTRY

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In this paper the impacts of Electronic Commerce (EC) on the international marketing strategies for the information service industries are studied. In seeking to blend humanistic concerns in this research with technological development by addressing challenges for deterministic attitudes, it also examines critical environmental factors relevant to Internet commerce in the changes of the international marketing environment The needs for a new marketing paradigm for EC, which comes out of new trends of international electronic marketing, is also examined. The impacts of EC for the information service industry were discussed and a hierarchy fuzzy multicriteria decision-making (Fuzzy MCDM) method for evaluating the propagating EC market strategies is proposed. Finally, in order to show the practicability and usefulness in this method, an example is taken as a verifiable method. From the results of practical applications in evaluating the electronic marketing strategies, the proposed method is appropriate and appears to be ideal for a fuzzy environment.

INTRODUCTION

Since the Internet was built by the US government in the late 1960s, information and communication technologies of electronic commerce (EC) have shortened business transaction cycles in virtually every industry and fierce global competition has put a premium on sharing information among product designers, manufacturers, and distributors. Businesses must now compete in terms of service, quality and cost against an ever increasing list of rivals. However, the information products or services that can be delivered directly to the consumers via computer networks, not via physical distribution channels. Information service industries include computer software, electronic book, newspaper, magazine, movie, television, video game, picture, newsletter, and music industries. Broadly defined, EC is a modern business methodology that addresses the needs of merchants, organizations, and consumers to cut costs while improving the quality of goods and services and increasing the speed of service delivery (Kalakota and Whinston, 1996) for raising the efficiency and usefulness increasing the revenue. How EC influences the strategies of international marketing is of great importance for practical applications and academic researches. The study presented here analyzes the impact of EC on the international marketing environment, strategies, and future trends in the information service industry. The purpose of this study first focuses on exploring the properties of information service industries and related issues concerning business activity, socio-economics, information management. Then, through the analysis of the impacts of EC on the international marketing environment, we develop a conceptual model to explain the relationship among information infrastructure, EC, international marketing environment, and the new international marketing paradigm. Lastly, we examine the impacts of EC on trends in international marketing strategies. Streeter et al. (1996) apply multiple regression analysis to estimate the impacts of the Internet for customer (user) and for lifestyle change (society) on relationships of the efficiency, the service qualities and so on. Quelch and Klein (1996) examine the opportunities and challenges facing multinational corporations marketing decision making in the EC environment. In addition, Hoffman and Novak (1996) emphasize the importance of innovative marketing paradigms from the viewpoint of new media. Armstrong and Hagel (1996) suggest that creating on-line communities can strengthen the customer loyalty. From the viewpoint of business process reengineering (BPR), Lee and Clark (1997) analyze the opportunities and challenges caused by electronic market systems. Analysis of a specific industry, was done by Angehrn and Meyer (1997), who develop a strategic framework to thoroughly study the current strategic positions of the banking industry and explore future strategic trends, and by O'Reilly (1996), who discusses the publishing model for the Internet commerce. Therefore, based on the ideas of above literatures by using the concepts of multiattribute strategies for reengineering business process of information service industries, a hierarchy a hierarchy fuzzy multicriteria decision-making (Fuzzy MCDM) method for evaluating the propagating EC market strategies was proposed. Finally, in order to show the practicability and usefulness in this method, an example was taken as a verifiable method.

CHANGES IN THE ELECTRONIC MARKETING ENVIRONMENT

Historically, technological advances have affected in social and economic transformation on a vast scale. This has been especially true when new technologies have unfolded across space as well as time. Before analyzing the impact of EC on international marketing strategies, we must have an understanding of the changes in the international marketing environment from viewpoints of business activity, socio-economic, social behavior on culture and politics, and information types.

Business Activity

Change in Business Process. Kalakota and Whinston (1996) hold that EC is well suited to facilitate the reengineering of business processes occurring at many firms. The broad goals of reengineering and EC are remarkably similar: reduced costs, lower product cycle times, faster response to customer requests, and improved service quality. Lee and Clark (1997) use the viewpoint of business BPR to analyze the opportunities and challenges resulting from electronic market systems. Because all the products in information service industries can be presented in the forms of texts, graphs, sounds, images, pictures, videos, animations, and any other digital information, these digital products can be transmitted to customers through the Internet without the use of physical distribution channels for increasing and achieving the information value. According to the evolution process the information service industries in business process can be classified two stages.

Generic business processes of conventional information service industries. The generic business processes of conventional information service industries have built the concept between information service providers and customers (users). In this concept how the information service providers may deal with their promotion activities through advertising and promotion in media like TV, electronic newspapers, magazine, etc. These acquisition and communication channels include electronic documents, magnetic medium, facsimiles, emails, and telephone communications. Also, in the generic situation, the consumers must make contact with the product distribution channels and go to the markets in person to select and purchase the desired information products, such as computer software, books, newspapers, music CDs, movies, and video games. Consumers can either pay in cash or employ the electronic funds transfer to complete the payment procedures. The contents of the information service are usually provided by the creators of the information services.

Business process reengineering of information service industries. We provide the information for customer (users) in the business processes of information service industries, after the implementation of EC. The resulting BPR integrates all the value chains and international marketing activities of these industries. The EC environment involves the medium of promotions and advertising, transactions, customer communications, information product development, acquisitions, and services, international marketing researches, designs of pricing strategies, distribution channels, and electronic payment services. In addition, information service firms can employ the Internet to communicate with their international customers and information creators.

Change in Transaction Costs

The development of EC implies a change in transaction costs among corporations and consumers. The concept of "transaction costs" originally introduced by Coase (1937) includes search costs necessary to set up the minimum social unit for the exchange. This includes the costs to establish and operate information channels and decision processes. The theory of transaction costs is usually used to analyze the impact of information technology (IT) applications on organizational structures and strategic management. Malone, et al. (1987) use transaction cost theory to suggest that IT, by reducing transaction costs, will reduce forces for vertical integration and induce a move to a market structure. Clemon and Row (1992) also employ transaction cost theory to argue that the use of IT, through explicit IT-based coordination, will bring about a move to the middle resulting in a network of interacting organizations. Besides, Ciborra (1993) provides a comprehensive discussion of the role of transaction cost theory in explaining IT-enable formation of teams, markets, and hierarchical structures. More recently, Kumar and Dissel (1996) employ the theory to explore the formation of IOSs, analyze the potential conflicts caused by IOSs, and propose the corresponding strategies to prevent the occurrence of conflicts.

Socio-Economics

Mitigating the Regional Difference on Information Asymmetries. In the conventional environment of international marketing, owing to the geographical distance and time constraint, the flow and acquisition of information is difficult and slow. Therefore, it has caused the difference of regions and countries in living-standard, thinking, behavior, and so on. However, the implementation of EC will accelerate the information flow and acquisition, and make it more convenient for consumers to acquire information transmitted from other places in the world. The phenomenon of product information asymmetries can be moderated by transmitting the digital products over the Internet, which makes it possible for the consumers to try out the products before purchasing them. Therefore, EC certainly mitigates the degree of information asymmetries in the international region-markets.

Change in organizational structure. The main argument of the collective school of thought is that the diffusion of any technology is a matter of social rather than individual choice. The enabling technologies of EC are pervasive not only in product transactions but also in other social attributes such as organizational structure, politics, education or culture (Armstrong et al., 1996). Large, hierarchically structured companies continue to downsize in the face of dramatic shifts from traditional corporate jobs to newly created opportunities in the burgeoning world of small businesses, entrepreneurial activities, telecommuting, and on-line marketing. Cyberspace is making it possible for small companies to take advantage of some opportunities traditional affordable only to big companies. Although starting any small business these days is as much headache as adventure, setting up a Web site and opening for business can be simpler and less expensive, with the right professional help, than setting up an equivalent retail store. Within the organization, configurations of work teams will be created and recreated to respond to the everyday challenges of markets (Hoffman et al., 1995). Installing e-mail, for example, on the computers of all members within an organization may mean that from now on members can directly communicate with the head of the organization without having to go through his or her secretary. Email facilitates communication between those at the bottom of the organizational hierarchy and those at the top, thus having a democratizing effect on organizations. This could represent a change in the communication channels within departments, causing individuals who feel threatened by the change to resist it (Markus, 1994). Relationships between sellers and customers are being altered by the spread of EC. An indirect consequence may be organizational changes within the selling firms, whether they are manufacturers, distributors, retailers, or service providers. In essence, the firm will not be a fixed conglomeration of building, offices, organizational charts, and job descriptions. This emancipates the investors from the compulsory consultation of brokers and reduces the agent's engagement to merely the execution of orders (Angehrn et al., 1997).

Change in global culture. Culture rises from geography because place is a primary shaper of the soul. Place is the character of a particular landscape as altered by human occupation. Moreover, culture is what happens when individual souls find themselves gathered and interacting in this place (Rennie, 1993). The Internet can expand our sense of shared culture by expanding our opportunities for exposure to the humanities. The world is great literature, art, music, film, and media yet to be developed will be, quite literally, at our fingertips. Cultural and multilingual issues arise with the ubiquitous nature of the Internet. Computer-mediated conferencing has facilitated the creation of virtual global communities that stand to redefine our notion of self and community. There is cause for an optimistic view regarding the development of a global village of good will. English is clearly the primary language of the Internet, and there do not appear to be any forces likely to turn the tide away from English as the standard language of choice. However, several nations are resisting allowing access to the Internet because of the dominance of English. Efforts must be make to find a way for all to the benefit from global achievement and to personalize Internet services to people with different languages and cultural backgrounds. Virtual communities could be very ill-defined in the accommodation of cultural and social norms, and yet the challenge is all the more significant because commerce on the Internet potentially must address an international marketplace. With the evolution of virtual communities, the organization as an individual operating environment may cease to exist as co-operative ventures become the norm and business boundaries become blurred; society will increasingly find it more difficult to retain cultural mores and restrain growth through information control.

Change in virtual education. Education is by many measures the world's potentially largest EC industry. Globalization allows new methods of packaging and delivering educational products for changing habitual domains to expand competence sets, i.e., to enrich traditional methods of knowledge acquisition and to enhance the new skills and tools needed to educate productive and creative members of the information society (Yu, 1990, 1995). Virtual education may become the norm, as some have suggested, as the least expensive way to deliver the educational products, while face-to-face teaching may turn into for the well-to-do. Instead of teaching about the use of technology, new courses are being developed to focus on the effective use of information. Telecommuting to workplace and school presents the practical promise of virtual learning. The growth of telecommuting represents a shift in the definition of workers' productivity. Most jobs now involve manipulating storable and retrievable knowledge. The result of that manipulation defines productivity. Where the work is done, or who sees it done, is of decreasing importance. Managers and workers are taught how to identify their own information needs, how to share information effectively with others, and how to make information-based decisions (Auger and Gallaugher, 1997). Universities develop course offerings involving how to search for information and use it effectively, consistent with a newly popular emphasis on lifelong learning. Also, the use of e-mail to administer a research project will likely be much more extensive in academic research on most subjects in the future. The response rate and the quick turnaround time all suggest that virtual education and training may prove valuable tools to researchers and the business community.

Effect on governmental and political transformation. Information technologies do not merely deliver sundry consumer benefits; they constitute part of a society's core political infrastructure. Information Technologies do this by establishing an intricate and pervasive network of structurally consequential political influences, opportunities, and constraints. Governments today are faced with increasing difficulty in maintaining the traditional borders that they have relied upon for political control. As these borders crumble, new political forms and arrangements are certain to evolve, in unpredictable ways. Change has become a political constant. Information technology is at the core of the current process of more global change at an ever-accelerating pace. The forms of communication that engender change (i.e., pagers, cellular phones, calling cards, fax, toll-free numbers, email, videoconferencing, and online forums), have never been so propitiously available. The dynamics of delivery and chaos in online communities bring with them promises but also potential challenges. With regard to political parties, the flirtation of more and more candidates with forming a new party or running as an "independency" is an indication of a more diverse electorate than perhaps can be truly represented by a two-party systems. It remains to be seen whether the two-party systems can maintain its hold on the political process in the presence of splintering culture and the influence of online constituencies. The threat of more divisiveness, more lobbyists, more shrillness in the national discourse, and less unity and cooperation becomes a definite possibility with the formation of specialized online forums and sites (Heilemann, 1997). The political humor and opinions have always been a key part of the political process but indexed and accessible by topic or name on the Internet, they could be more influential than ever in changing perceptions and the landscape of politics. Moreover, the shift away from reliance on centralized government solutions towards local solutions for individuals, families, and neighborhoods may do more to improve our personal lives than any amount of the national politics. Seeking local solutions is the wave of change most readily enabled by cyberspace-interdependence. Government sponsored "megasites" are more common in Asia than in the United States and reflect the Asian countries' emphasis on government-led economic development. However, government support and cooperation in allowing the free flow of trade and ideas, agreeing on issues such as data security, taxation on transactions, and infrastructure will be critical for the Internet's future expansion. Numerous issues will need to be studied: defining the roles of national governments in limiting the inflow of ideas, defining national boundaries for regulated industries.

Information management

Change in MIS. Since more services are based on maintaining customer databases and direct electronic communication links, the management information systems (MIS) will become a key to making the corporate strategic plan reality. Its success will be based on its ability to translate a service delivery strategy into an effective IT infrastructure. End-customer systems will be very demanding of MIS skills and resources. Internet user demographics projects are currently under way in different countries to collect and analyze survey data on Internet users to acquire preliminary information on behavior, attitudes, opinions, and demographics. By taking advantage of similar survey techniques to collect updated information, information systems managers must be extremely end-user focused. The transition to an information service-driven economy also results in a different strategic focus. The industrial era notion of building competence based on manufacturing capability may become obsolete. The core competency of organizations will be increasingly founded on the ability to deliver service. This implies that many organizations need to redefine their fundamental purpose and transform from thinking about products to thinking about services and the customer's ultimate goal. In a volatile, dynamic Internet environment, there is no simple information management formula guaranteeing success. A willingness to take timely advantage of relevant Internet technology and applications and a consistent emphasis on product development are all needed in ensuring MIS achievement.

WWW challenges. EC is emerging as an increasingly important way for organizations to reach potential customers. However, EC presents many challenges to the organizations that implement it. It has been hailed as a means for companies to improve productivity and cash flow, decrease inventory, and enhance customer relations, but empirical research has yet to confirm that organizations view it in this positive fashion. An increasingly Internet literate consumer will be an important factor in the support of electronic marketing, but this does not mean that the trend is strong enough yet to ensure success. Consumer demand for these services is uncertain, to say the least. Some believe that the Internet shopping mall has a long way to go before it reaches its full potential (Lederer et al., 1997). Although considerable work is being done to improve EC, the technology is still too immature to bank on. Current interest in EC also has not translated into extensive sales across the industries. Moreover, establishing organizations of EC operations would require enormous capital and cooperation between participants. Responsibilities to consumers include not only guarantees of privacy and security but also customer service and protection against fraudulent claims and deceptive advertising. The impact of the emergence of EC to having organizations' products and services delivered directly to business and customer is for the time being uncertain. It depends heavily on customer acceptance, telecommunications bandwidth availability and costs, and network security development. Some companies even contemplate cutting back on their EC presence, as they can see short-term benefit of doing so. Education and training become cheaper through electronic education services on the Internet, and technological skills and productivity in the electronic marketplace will level off among workers in many types because the difference between high-tech and low-tech professionals is smaller than in physical markets. For these reasons, the income gap is expected to narrow as the Internet grows. Some economics issues of concerns include a shift from labor-intensive jobs to information-intensive jobs requiring new skills and training, upholding intellectual property, increasing the number of business transactions that are handled through mail and personal travel, and infrastructure support for electronic payment and brokerage systems (Quinn, 1992).

BUILDING A HIERARCHY STRATEGY MODEL FOR EVALUATING THE INTERNATIONAL ELECTRONIC MARKETING

In recent, Kalakota and Whinston (1996) hold that the information infrastructure is composed of information superhighway, multimedia content and network publishing, the messaging and information distribution, and common business services infrastructures. The common business services infrastructure consists of services for security, authentication, electronic payment, directories/catalogs and so on.

Building a Hierarchy Strategy model

We apply the PATTERN (Planning Assistance Through Technical Evaluation of Relevance Number) method and concept (NASA PATTERN, 1965,1966; Tzeng, 1977; Tzeng and Shiau, 1987) to build a hierarchy strategy system for evaluating international electronic marketing strategies. Its analytical procedures include three steps: (1) scenario writings, (2) building a relevance tree, and (3) evaluation. In this subsection, we focus on scenario writings and building a relevance tree. Scenario writings is based on catching the habitual domain (Yu,1985, 1990, 1995), i.e., past understanding of problems, experience, knowledge and information derived from brainstorming techniques discussed in previous sections to probe the effects of catching the optimal trends of the international electronic marketing strategy (goal level). Then the question becomes how can this goal be achieved on the effects. We can consider the problem from three viewpoints: (1) business development (information providers, i.e., information investors), (2) customers (information users), and (3) socio-economics. According to the literature reviews and experience, relevance trees are used to create hierarchy strategies for catching the optimal trends of the international electronic marketing strategy using scenario writings. The elements (nodes) of relevance trees are "a relevance set" composed of statements derived from "goal" (high level) through aspect, objective, policy or strategic planning, to the implementation (lower level). Elements (nodes) of relevance trees are defined and identified in hierarchy strategies through brainstorming concepts; they are located at every level from the interaction feedback procedure of high to low levels (top down) and from the low level integrated up to the high levels (bottom up). Such a system structure institutes evaluation hierarchy strategies for catching the optimal trends of the international electronic marketing strategies as shown in Fig. 1 (The international electronic marking strategies will be described in the next section).

A New Paradigm of Electronic Marketing Strategies of the Information Service Industry

As discussed earlier, the development of EC implies changes in the international marketing environment. Therefore, a new paradigm for electronic marketing strategies of the information service industry deserves further analyses of positioning, consumer loyalty, advertising, marketing skills, distribution, brand, differentiation, product development, product mix, packaging, customer service, pricing, electronic payment systems, and marketing research shown as Table1.

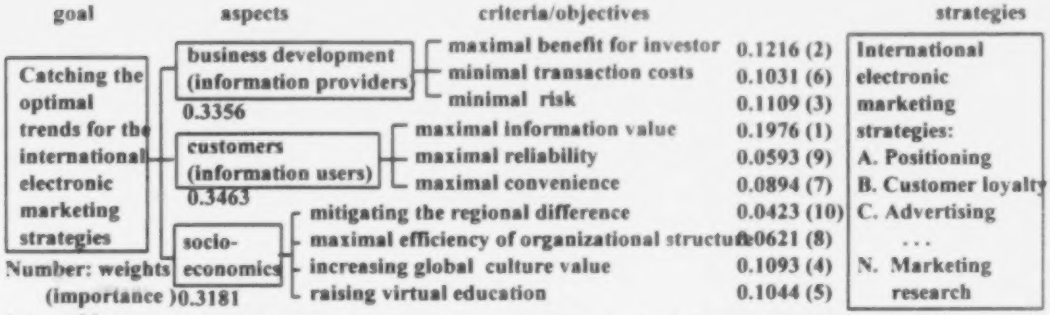

goal
aspects
criteria/objectives
strategies
Catching the optimal trends for the international electronic marketing strategies
business development (information providers)
0.3356
customers (information users)
0.3463
socio-economics
0.3181
maximal benefit for investor
minimal transaction costs
minimal risk
maximal information value
maximal reliability
maximal convenience
mitigating the regional difference
maximal efficiency of organizational structure
increasing global culture value
raising virtual education
0.1216 (2)
0.1031 (6)
0.1109 (3)
0.1976 (1)
0.0593 (9)
0.0894 (7)
0.0423 (10)
0.0621 (8)
0.1093 (4)
0.1044 (5)
International electronic marketing strategies:
A. Positioning
B. Customer loyalty
C. Advertising
. . .
N. Marketing research
Number: weights (importance)
( ): rankings

Fig. 1 Relevance system of hierarchy strategies for information service industry

TABLE 1
ELECTRONIC MARKETING STRATEGIES AND TRENDS OF INFORMATION SERVICE INDUSTRIES

International marketing issues	Electronic marketing strategies and trends
A. Positioning	The result of market positioning evaluation can be divided into four quadrants, including "investment (growth)", "strengthen the company's edge of e-commerce (be careful)', "don't enter (safety)" and harvest (exploration)".
B. Customer loyalty	By creating healthy on-line communities, business will be able to build customer loyalty to a degree that today's marketers can only dream of and, in turn, will generate strong economic return (Armstrong and Hagel, 1996).
C. Advertising	EC allows marketers to collect a large amount of customers' personal data and consumption behaviors from the Web to construct their own comprehensive databases, which provide a great diversity of promotion, advertising, and discount policies, depending on consumers' characteristics and product preferences

TABLE 1
(continued)

D. Marketing skills	Marketing personnel must enlarge their domain knowledge, learn how to take advantage of information technology to attract customers and increase the customer loyalty, and realize the strategic of EC on international marketing.
E. Distribution	The distribution strategy in information service industries no longer puts emphasis on the selection of physical distribution channels and store locations, but on that of intermediaries providing value-added and consulting services.
F. Brand	The development of brand identity is critical to information service providers because brand identity could strengthen consumers' trust in their digital products and on-line transaction procedures.
G. Differentition	Due to numerous information content, world-wide consumers, lower communication and transaction costs, small companies offering specialized niche products should be able to find the critical mass of customers necessary to succeed.
H. Product development	Developers of information products can take advantage of the low-cost communication of the Internet and Intranet to exchange product-related information with each other and improve their management efficiency of project schedules, budgets and human resources.
I. Product mix	The information service industries in EC not only adopt the personalization policy providing consumers with various information, but also undertake the customization policy allowing consumers to select and bundle their desired product mixes, depending on their preferences, leading to the prevalence of micromarketing.
J. Packaging	Information interfaces of Web sites which become the sole communication channels for on-line companies and consumers will have a great influence on consumers' will to browse Web sites and purchase products.
K. Customer service	The customer service strategy of information products in the EC environment is to provide customers with global, instantaneous, interactive, and personalized services.
L. Pricing	To tailor the product to a variety of markets, information service providers should design various pricing policies in accordance with the content mix, transmitted speed, accuracy, priority, and other related services of information products.
M. Electronic payment	Due to the face-to-face communication in the on-line marketing circumstances, where all the payment and settlement procedures are carried out on the Internet, the security and convenience of electronic payment systems have a great influence on consumers' desires to make transactions Web sites.
N. Marketing research	The Internet, a new media with fast information distribution and feedback, expands the acquisition channel of market data and decreases the difficulty and cost of conducting international marketing research.

Table 1 is provided the evaluators (experts) as a considering base for rating scores of the effects on each objective from three aspects: information providers, information users, and socio-economics (see Fig. 1). We propose one method for evaluating the electronic marketing strategies in the international information service industry described in next section.

EVALUATING THE HIERARCHY SYSTEMS FOR ELECTRONIC MARKETING STRATEGIES

Traditional evaluation methods usually take the minimum cost or the maximum benefit as their only single index of measurement (Tzeng and Tsaur, 1993; Tsaur et al., 1997), but in an increasingly complex and diversified decision-making environment, this approach may sacrifice too much valuable information in the process. Thus, in this study we propose a multiple criteria decision-making (MCDM) method to evaluate the hierarchy systems for electronic marketing strategies. The information service industry is a newly-risen and quickly-changing industry judging present trends. As result, the effects of electronic marketing strategies and trends on each objective are uncertain. The concept of perceived objectives/criteria (such as risk, information value, reliability, convenience, regional differences, culture, etc.) most often used by researchers defines vague objectives in terms of the consumer's or producer's perceptions both of the uncertainty and the magnitude of the possible adverse consequences. Since the extent to which vague objectives/criteria are captured by research is itself not known with certainty, the evaluation is conducted in an uncertain, fuzzy environment. During the process of evaluation, indices of objective measurement cannot be determined while the expert evaluators are unclear about objective measurement, since this could make the values imprecise and create too large an allowance for error. Therefore, in this study we propose a fuzzy multiple objectives/criteria evaluation method for evaluating the effects of electronic marketing strategies on the information service industry. The processes of evaluating the hierarchy strategies are introduced in the next two sections.

The Processes of Evaluating the Hierarchy Strategies

The processes of evaluating the hierarchy strategies includes three steps: (1) assessing the weights (relative importance grade) of each strategic item, (2) getting the performance value of each strategic item from the sense of experts, and (3) evaluating the strategic items.

Evaluating the weights for the hierarchy relevance system. The AHP weighting (Saaty, 1977, 1980) is mainly determined by the evaluators who conduct pairwise comparisons, so as to reveal the comparative importance of two criteria. If there are n evaluation criteria/objectives (items or nodes), then the decision-makers have to conduct $C(n,2)=n(n-1)/2$ pairwise comparisons. Furthermore, the relative importance derived from these pairwise comparisons allows a certain degree of inconsistency within a domain. Saaty used the principal eigenvector of the pairwise comparison matrix derived from the scaling ratio to find the comparative weigh among the criteria (as aspects and criteria/objective, see Fig. 3) of the hierarchy systems for electronic marketing strategies.

Suppose that we wish to compare a set of n criteria/objectives in pairs according to their relative importance (weights). Denote the criteria/objectives by $C_1, C_2, \ldots, C_n$ and their weights by $w_1, w_2, \ldots, w_n$. If $w=(w_1, w_2, \ldots, w_n)^T$ is given, the pairwise comparisons may be represented by a matrix □ of the following formulation:

$$(A-\lambda_{\max} I)w=0 \tag{1}$$

Equation 1 denotes that is the matrix of pairwise comparison values derived from intuitive judgment (perception) for ranking order. In order to find the priority eigenvector, we must find the eigenvector with respective λ_{ma} which satisfies $Aw=\lambda_{\max} w$. Observing from intuitive judgment for ranking order to pairwise comparisons to test the consistency of the intuitive judgment that since small changes in elements of matrix imply a small change in λ_j $\left(\sum_{j=1}^{n}\lambda_j = tr(A)\right.$ = sum of the diagonal elements = , therefore only one of λ_j, we call it λ_{ma}, equals , and if $\lambda_j = 0$, then $\lambda_j \neq \lambda_{\mathrm{ma}}$), the deviation of the latter from is a measure of consistency, i.e., C.I. = $(\lambda_{\max}-n)/(n-1)$, the consistency index (C.I.), as our indicator of "closeness to consistency." In general, if this number is less than 0.1, we may be satisfied with our judgment (refers to Saaty, 1977, 1980).

In this problem, the group decision-makers should at least need to include three groups (three aspects in Fig. 3): (a) information providers (managers of information producer), (b) information users (customers), (c) representers of socio-economics (socio-economic researchers).

Getting the Performance Value

The evaluators (experts in electronic marketing) choose a score (performance value) for each electronic marketing strategy based on their subjective (intuitive) judgment. This way the methology for estimating the achieving level of each criterion/objective in each electronic marketing strategy and future tends of the information service industries can use the methods of fuzzy theory for treating the fuzzy environment. Since Zadeh introduced fuzzy set theory (Zadeh, 1965), and Bellman and Zadeh (1970) described the decision-making method in fuzzy environments, an increasing number of studies have dealt with uncertain fuzzy problems by applying fuzzy set theory. The application of fuzzy theory to get the performance values can be described as follows:

Fuzzy number. Fuzzy numbers are a fuzzy subset of real numbers, and they represent the expansion of the idea of the confidence interval. According to the definition of

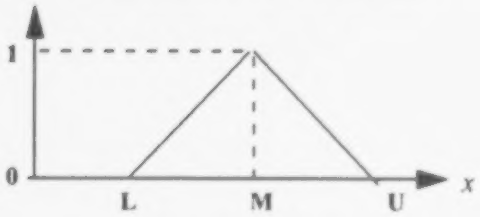
Dubois and Prades (1980), the fuzzy number $\tilde{A}$ is a fuzzy set, and its membership function is $\mu_{\tilde{A}}(x)$: $R\rightarrow(0,1)$ and Is enshrined with the following characteristics.

(i) $\mu_{\tilde{A}}(x)$ is a continuos mapping from to the closed interval 0,1; (ii) $\mu_{\tilde{A}}(x)$ is a convex fuzzy subset; (iii) $\mu_{\tilde{A}}(x)$ is the normalization of a fuzzy subset, which means that there exists a number x_0 that makes $\mu_{\tilde{A}}(x_0) =$.

Those numbers that can satisfy these requirement will then be called fuzzy numbers, and the following is explanation for the characteristics and operation of the triangular fuzzy number as shown in Equation (2) and Figure 2.

$$\mu_{\tilde{A}}(x)=\begin{cases}(x-L)/(M-L), & L\le x\le M\\ (U-x)/(U-M), & M\le x\le U\\ 0, \quad \mu_{\tilde{A}}(x) & otherwise\end{cases} \tag{2}$$

FIGURE 2
THE MEMBERSHIP FUNCTION OF THE TRIANGULAR FUZZY NUMBER



According to the characteristics of triangular fuzzy numbers and the extension principle put forward by Zadeh (1965), the algebraic operation of the triangular fuzzy number $\mu_{\tilde{A}_1}(x)=(L_1,M_1,U_1)$ and $\mu_{\tilde{A}_2}(x)=(L_2,M_2,U_2)$ can be displayed as follows:

- Addition of a fuzzy number

$$(L_1,M_1,U_1)\oplus(L_2,M_2,U_2)=\\(L_1+L_2,M_1+M_2,U_1+U_2) \tag{3}$$

- Multiplication of a fuzzy number ⊗

$$\text{(i)}\quad (L_1,M_1,U_1)\otimes(L_2,M_2,U_2)=\\(L_1L_2,M_1M_2,U_1U_2), L_1\ge 0, L_2\ge 0 \tag{4}$$

(ii) Any real number *k*

$$k\otimes\mu_{\tilde{A}}(x)=(k,k,k)\otimes(L,M,U)=\\(kL,kM,kU) \tag{5}$$

-Subtraction of a fuzzy number −

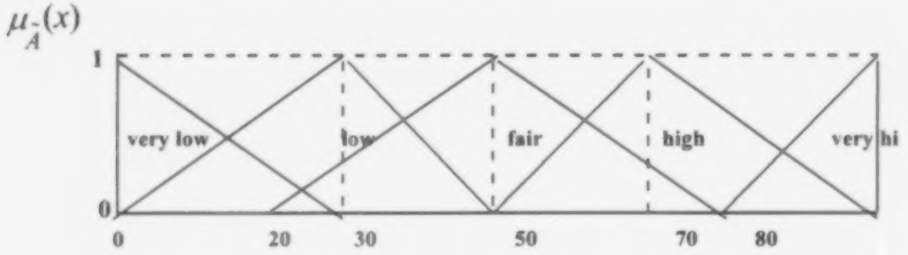
$$(L_1,M_1,U_1)-(L_2,M_2,U_2)=\\(L_1-U_2,M_1-M_2,U_1-L_2) \tag{6}$$

-Division of a fuzzy number ÷

$$(L_1,M_1,U_1)\div(L_2,M_2,U_2)=\\(L_1/U_2,M_1/M_2,U_1/L_2), L_1\ge 0, L_2\ge 0 \tag{7}$$

Linguistic variable. According to Zadeh (1975), it is very difficult for conventional quantification to express reasonably those situations that are overtly complex or hard to define; thus the notion of a linguistic variable is necessary in such situations. A linguistic variable is a variable whose values are words or sentences in a natural or artificial language. For example, the expressions of criteria/objectives as "risk of information providers," "information value, or reliability, or convenience of information users," "difference level of regions," "efficiency of organizational structure," "global culture value" and so on all represent a linguistic variable in the context in these problems (see Fig. 1). Linguistic variables may take on effect-values such as "very high (very good)," "high (good)," "fair," "low (bad) ," "very low (very bad)." The membership functions of the effect-values can be indicated by triangular fuzzy numbers, which are as shown in Fig. 3. The use of linguistic variables is rather widespread at present, and the linguistic effect-values of electronic marketing strategies found in this study are primarily used to assess the linguistic ratings given by the evaluators. Furthermore, linguistic variables are used as a way to measure the achievement of the performance value for each criterion/objective.

FIGURE 3
THE MEMBERSHIP FUNCTION OF THE FIVE LEVELS OF LINGUISTIC VARIABLES



Evaluating Electronic Marketing Strategies

Bellman and Zadeh (1970) were the first to probe the decision-making problem in a fuzzy environment, and they heralded the initiation of fuzzy multiple criteria decision-making (Fuzzy MCDM). Our study uses this method to evaluate the electronic marketing strategies, and ranks it for each strategy. The method and procedures of Fuzzy MCDM theory are as follows:

Measuring criteria/objectives. Using the measurement of linguistic variables to demonstrate the criteria/objectives performance (effect-values) by expression such as "very high," "high," "fair," "low," "very low," the evaluators are asked to make their subjective judgments, and each linguistic variable can be indicated by a triangular fuzzy number (TFN) within a range of 0-100. Also the evaluators can subjectively assign their personal weights to the linguistics variables.

Let E_{ij}^{k} indicate the fuzzy performance value of evaluator k toward strategy i under criterion/objective j, and let the performance of the criteria/objectives be indicated by the set S, then,

$$E_{ij}^{k} = (LE_{ij}^{k}, ME_{ij}^{k}, UE_{ij}^{k}),\ j \in S \qquad (8)$$

Since the perception of each evaluator varies according to the evaluator's experience and knowledge, and the definitions of the linguistic variables vary as well, the study uses the notion of average value so as to integrate the fuzzy judgment values of evaluators, that is,

$$E_{ij} = (1/m) \odot (E_{ij}^{1} \oplus E_{ij}^{2} \oplus \ldots \oplus E_{ij}^{m}) \qquad (9)$$

The sign

$\odot$ denotes fuzzy multiplication, the sign denotes fuzzy addition. E_{ij} is the average fuzzy number of the judgment of the decision-maker, and it can be displayed by a triangular fuzzy number as follows:

$$E_{ij} = (LE_{ij}, ME_{ij}, UE_{ij}) \qquad (10)$$

The preceding end-point values

$LE_{ij} = \frac{1}{m}(\sum_{k=1}^{m} LE_{ij}^{k}), ME_{ij} = \frac{1}{m}(\sum_{k=1}^{m} ME_{ij}^{k})$, and

$UE_{ij} = \frac{1}{m}(\sum_{k=1}^{m} UE_{ij}^{k})$

can be solved by the method introduced by Buckley (1985).

Fuzzy synthetic decision. The weights of the criteria/objectives of electronic marketing as well as the fuzzy performance values (effect-values) have to be integrated by the operation of fuzzy numbers so as to be located at the fuzzy performance value (effect-value) of the integral evaluation, which is one of the procedures of fuzzy synthetics decision-making. According to the weight w_j derived by AHP, the weight vector can be obtained, and the fuzzy performance matrix of each of the strategies can also be obtained from the fuzzy performance value of each strategy under criteria/objectives, that is,

$$w=(w_1,\ldots,w_j,\ldots,w_n)^t \tag{11}$$

$$E=(E_{ij}) \tag{12}$$

From the weight vector

and fuzzy performance matrix , the final fuzzy synthetic decision matrix is,

$$R= \circ \tag{13}$$

The sign "0" indicates the operation of the fuzzy numbers, including fuzzy addition and fuzzy multiplication. Since the operation of fuzzy multiplication is rather complex, it is usually it is denoted by the approximate multiplied result of the fuzzy multiplication and the approximate fuzzy number , of the fuzzy synthetic decision of each strategy. The expression then becomes,

$$R_i=(LR_i,MR_i,UR_i),\forall i \tag{14}$$

where $$LR_i=\sum_{j=1}^{n} LE_{ij} * w_j \tag{15}$$

$$MR_i=\sum_{j=1}^{n} ME_{ij} * w_j \tag{16}$$

$$UR_i=\sum_{j=1}^{n} UE_{ij} * w_j \tag{17}$$

Ranking the strategies (fuzzy number). The result of the fuzzy synthetic decision reached by each strategy is a fuzzy number. Therefore, it is necessary that the nonfuzzy ranging method for fuzzy numbers be employed during the comparison fof the strategies. In other words, the procedure of defuzzification is to locate the Best Nonfuzzy Performance value (BNP). Methods of such defuzzified fuzzy ranking generally include mean of maximal (MOM), center of area (COA), and a-cut, three kinds of method (Zhao and Govind,1991; Teng and Tzeng, 1996). To utilize the COA method to find out the BNP is a simple and practical method and there is no need bring in the preferences of any evaluators. For those reasons, the COA method is used in this study.

The BNP value of the fuzzy number R_i can be found by the following equation:

$$BNP_i=[(UR_i-LR_i)+(MR_i-LR_i)]/3+LR_i,\ \forall i \tag{18}$$

According to the value of the derived BNP, the evaluation of each electronic marketing strategy can then proceed.

An Example and Discussions

In order to show the practicability and usefulness of this research, we give an example. The processes of evaluating the electronic marketing strategies can be expressed as follows:

Evaluating the criteria/objectives weights. We find the weights (importance) attributed to each criterion/objective by the following three decision-making groups: managers of producers (information providers), customers (information users, and socio-economic researchers. The criteria weights are shown as Table 2.

TABLE 2
THE CRITERIA WEIGHTS FOR EVALUATING ELECTRONIC MARKETING STRATEGIES

aspects and criteria/objectives	weights	total weights (w_j)
Information providers	0.3356	
maximal benefit for investor	0.3624	0.1216 (2)
minimal transaction costs	0.3071	0.1031 (6)
minimal risk	0.2583	0.1109 (3)
Information users	0.3463	
maximal information value	0.5705	0.1976 (1)
maximal reliability	0.1712	0.0593 (9)
maximal convenience	0.2583	0.0894 (7)
Socio-economics	0.3181	
mitigating the regional difference	0.1329	0.0423 (10)
maximal efficiency of organization structure	0.1952	0.0621 (8)
increasing global culture value	0.3438	0.1093 (4)
raising virtual education	0.3281	0.1044 (5)

Parentheses ( ) denote the order of importance (weight) of each criterion/objective.

Estimating the performance matrix. The evaluators can define their own individual range for the linguistic variables employed in this study according to their subjective judgments within a scale of 0 -100. Table 3 shows the degree of variation in their definitions of the linguistic variables. Thus, this study can employ the method of average value to integrate the fuzzy judgment values of different evaluators regarding the same evaluation criteria/objectives. In other words, fuzzy addition and fuzzy multiplication can be used to solve for the average fuzzy numbers of the performance values under each evaluation/objective shared by the evaluators for the fourteen electronic marketing strategies (shown as Table 4).

TABLE 3
THE SUBJECTIVE PERCEPTION OF EVALUATORS OF THE FIVE LEVELS OF LINGUISTIC VARIABLES

Evaluators	very low	low	fair	high	very high
1	(0, 0, 21)	(18, 31, 44)	(40, 48, 56)	(55, 69, 82)	(80, 100, 100)
2	(0, 0, 40)	(40, 50, 60)	(60, 65, 70)	(70, 80, 90)	(90, 100, 100)
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
m	(0, 0, 25)	(20, 30, 40)	(35, 40, 45)	(50, 60, 70)	(80, 100, 100)

Ranking the electronic marketing strategies. From the criteria weights obtained by AHP and the fuzzy performance values of each criterion, the final fuzzy integrated decision can then be conducted. After the fuzzy integrated decision can be conducted and subsequently the nonfuzzy ranking method can be employed, finally the fuzzy numbers will be changed into nonfuzzy values. Though there are methods to rank these fuzzy numbers, this study can use COA to find out the BNP value which is used to rank the electronic marketing strategies of each strategy: $N \succ H \succ E \succ B \succ D \succ C \succ K \succ J \succ I \succ M \succ G \succ A \succ F$. Our illustrated example is based on the results of a generalized model making a number of our research group to explain the concept of this method for evaluating the electronic marketing strategies in fuzzy environment. From the results of practical applications in evaluating the electronic marketing strategies, the proposed method makes good evaluation and appears to be the most appropriate in fuzzy environment.

CONCLUSIONS

Marketers all over the world agree that EC will have major impact on the way firms do business. What changes will occur is hard to predict as the Internet is in a phase of rapid growth and constant change. This paper has looked at the prescriptions given in the literature as to how EC willinfluence the scope, style, and marketing of products across national boundaries. This paper has particularly focused on the electronic marketing implications for the strategies and trends of the information service industry. As a company grows, management may find it necessary to reconfigure both its internal and external structures as part of its strategic response. That means that marketing as well as other environmental issues all need to be considered when evaluating the EC applications. This study has analyzed the changes in the international marketing environment and then presented a conceptual framework to expound the relationships among the information infrastructure, EC, the international marketing environment, and the hierarchy fuzzy MCDM method for international marketing. This paper has discussed the impact of EC on several international marketing issues, including positioning, consumer loyalty, advertising, marketing skills, distribution, brand, differentiation, product development, product mix, packaging, consumer service, pricing, electronic payment and marketing research in the information service industry.

Lastly, our illustrated example is based on the results of a generalized model evaluating the electronic marketing strategies in fuzzy environment. From the results of practical applications in evaluating the electronic marketing strategies, the proposed method is appropriate and appears to be ideal for a fuzzy environment.

Given that this a first attempt to formally model the effects of the Internet on international marketing strategies by using fuzzy MCDM, we believe that the insights gained herein are a significant theoretical contribution to the literature and lay the groundwork for future research. In order to render a more complete and pragmatic characterization of the EC's effects on electronic marketing strategies, the evaluation hierarchy systems will need to be examined at a lower level to catch the actual phenomena and the implementation strategies. A number of extensions would be clearly be interesting to explore, including the use of survey design and group decision-makers.

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HYPERMEDIA AIDS FOR ADVANCED LEARNING IN COMPLEX AND ILL-STRUCTURED KNOWLEDGE DOMAINS

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Using the cognitive fit paradigm as a theoretical framework, this study compared the problem-solving performance of users of a hypertext-based learning aid to the performance of users of a computer-based linear text learning aid. Learners' performance was compared on three levels of task complexity: Analysis, Synthesis and Evaluation. Results indicate that users of the hypertext-based learning aid were more effective and efficient at the highest level of complexity tested. This suggests that hypertext-based learning aids would be more appropriate to more complex learning tasks than to less complex ones.

INTRODUCTION

Along with the evolution of information technology (IT), computer-based learning has evolved from programmed instruction to some more complex content-focussed learning environments. With faster, more powerful and cheaper systems, the applications have multiplied. Today, learning environments come in all sizes and shapes. They engage learners in authentic context-sensitive learning tasks, support collaborative learning activities and socially-negotiated interpretations of domain knowledge, among other issues. Examples of these environments include anchored instruction, computer-supported intentional learning environments, and cognitive flexible hypertexts (Jonassen, 93).

Obviously, computer-based training and learning systems are not the solution to every problem in training and education. In the computer-based training and learning literature we can find encouraging results and discouraging ones. On one hand we found studies indicating that computer-based training (CBT) can improve learning, attitudes, and job performance (Adams, 93; Eberts, 88; Eberts and Brock, 84; Francis, 92; Kearsley, 85; Nelson and Palumbo, 92; Price, 91; Radlinski and McKendree, 92), on the other hand some studies did not clearly indicate the benefits of using CBT (Hiltz and Johnson, 90; Horowitz, 88; Leidner and Jarvenpaa, 93).

This resembles the graph *versus* tables controversy which went on during the 80s and early 90s. Vessey (91) offered an interesting explanation for the inconsistency of the results obtained by researchers. Using the cognitive fit paradigm, she proposed that the issue of fit between the task supported and the tool used had to be taken into account in order to adequately assess subject performance.

Following this line of thought, the research described here compared learning performance of subjects using two different computer learning aids, linear and hypertext. Performance was assessed for three levels of task complexity: analysis, synthesis, and evaluation.

The remainder of this paper describes the research and its results. In the following section we discuss IT and learning. The Cognitive Fit Paradigm is presented in Section 3. The research model and the hypotheses are outlined in Section 4. The research method is contained in Section 5. In Section 6 the results are presented along with a discussion of our findings and of the limitations of the study.

IT AND LEARNING

The potential for information technology to revolutionize education does exist. Part of the reason that information technology has yet to revolutionize daily classroom activities is its rapid evolution. It is very difficult to keep current in a field that is only a support for the primary activity, which is teaching. With so many options, it is hard to find the right fit between the available technology and the goals of learning.

Since the early versions of hypertext authoring tools, it has been argued that hypertext will have an impact on learning. In a way, by merely linking documents some assume that there will be major educational effects, that hypertext systems will solve most, if not all, educational problems, and that once students have access to hypertext they will dramatically improve in some almost magical way. This has prompted a strong reaction known as the "hype" of hypertext, or "hyper-expectations" These expectations have also prompted a reaction that considers hypertext just another *buzz word* and suggesting that those *promises* cannot be fulfilled.

In a theoretical review of the use of information technology (IT) to enhance management school education, Leidner and Jarvenpaa (95) looked at the pedagogical assumptions underlying the design of IT for educational purposes. In an effort to stimulate innovative applications and rigorous examinations of the effectiveness of these applications, they discussed five models of learning in the context of management education: objectivism, constructivism, collaborationism, cognitive information processing, and socioculturalism.

The objectivist model of learning is based on Skinner's (53, 69, 71) stimulus-response theory. The goals of learning here are to understand reality and modify our behaviour accordingly. Reality is seen as an objective entity waiting to be understood. Educators who agree with this model believe that expertise is an accumulation of knowledge and we need to be able to transfer this knowledge to novices. Here, knowledge is also an objective entity that can be stored and transmitted. So the main concern of educators in this model is to find an efficient way to do so. They believe that instructors are the source of knowledge and they should be in control of the learning process.

The main difference between constructivism and objectivism is that reality is understood differently by either theory. Constructivism sees reality as a subjective experience. Knowledge is not transmitted, but created in a series of interactions by each learner. This model calls for a learner-centred approach. Instructors are facilitators of knowledge, but learners should be in control of the process. Individuals learn better when they are forced to discover things themselves rather than by being told or instructed.

For the educators that adhere to the collaborationist model of learning, learning emerges through shared understanding of more than one learner. In other words, learning does not exist in isolation. So, in order to generate knowledge, socialization is promoted, as well as group skills, communication, listening, and participation. Involvement is seen as critical for learning. In this context, instruction is communication-oriented, and the instructor is seen as a questioner and a discussion leader.

The Cognitive Information Processing model looks at learning as the creation and transfer of new knowledge into long-term memory. Its goal is to improve the cognitive processing abilities of learners, by improving recall and retention. Here, prior knowledge affects the level of instructional support needed, and educators believe that learners have limited selective attention. So they are concerned about instructional aspects of stimuli that can affect attention. They need some kind of feedback on student's learning in order to adapt to their needs.

Finally, those who adhere to socioculturalism see learning as subjective and individualistic, and as a means to empowerment, and emancipation. They believe that action-oriented, socially conscious learners will change society rather than merely accept or understand it. Then, instruction is always culturally value-laden, and embedded in a person's every day cultural or social context.

It is easily understood that educators having different views of the education process will have different assumptions about how IT can help them achieve their goals. In order to classify these assumptions, Leidner and Jarvenpaa's (95) analysed different ways educators view information technology: As a means to automate, informate up, informate down, and transform. These "visions" are based on Schein's (92) organizational research in IT.

The vision to automate. When educators see IT as a way of replacing expensive, unreliable human labour with sophisticated systems and other information technologies, they have a vision to automate. They see in these technologies a way to save money, to improve quality, and to make schools more effective. They acknowledge that teaching and learning cannot be automated, but they believe there are some aspects that can be better served using computers, particularly the delivery of information. Within this vision, Leidner and Jarvenpaa (95) grouped the following technologies, since they are seen as prone to provide tools for manipulating and representing instructional material in a classroom: Instructors consoles with or without standalone student computers, Computer-Assisted Learning, and Distance Learning technologies.

The vision to informate up. For some educators, IT can become the ultimate educational control tool. They assume that by installing the right kind of information system they can monitor the educational process, pinpoint problems rapidly and prescribe remedial measures. Technologies that fit this purpose, identified by Leidner and Jarvenpaa (95) include key response pads and any kind of E-mail system that allows communication between instructors and students.

The vision to informate down. In an educational context, this means that instructors share the responsibilities of the learning process with learners, mainly by providing students greater access to information. Students now can critically analyse information and discuss issues between themselves and with the instructor. The technologies identified within this vision include Hypermedia, the Internet, Simulations, Virtual Reality, and Classrooms with synchronous communication devices either with or without group support (Leidner and Jarvenpaa, 95).

The vision to transform. In education this view will translate into a new understanding of the classroom, by making its physical boundaries obsolete; of teamwork, by having more effective interactions; of the learning process, by allowing it to become a continuous, time-independent process; and of the creation of knowledge, by enabling it to be a multilevel, multi-speed process. Leidner and Jarvenpaa (95), identified virtual learning spaces known as Asynchronous Communication Across Distances (ACADs) technology either with or without group support.

In order to assess the impact of IT on learning, Leidner and Jarvenpaa (95) evaluated each one of these visions against the five theories of learning regarding control of the pace and content of learning, and the purpose of instruction. They suggest that IS researchers, interested in this area, can benefit by using well-established variables from educational research rather than creating new ones. By examining well-defined learning outcome variables as dependent measures in studies of the impact of IT on learning, their findings will be more comparable and easier to interpret.

Hypermedia in general, and hypertext in particular places much of the control of the content and pace of learning in the hands of students. The purpose of study moves away from knowledge dissemination to knowledge creation. Much of the knowledge has already been created, i.e., is explicit, but the instructor is no longer the primary creator of it. Then its structure becomes very important and students become part of the knowledge creation process, while the instructor becomes a mediator rather than an adviser of the learning process.

We can conclude, that hypermedia is more properly used in constructivist or cognitive information processing environments, with an emphasis on conceptual learning and higher-order thinking. That was also noted previously by Jonassen (93), Duffy and Jonassen (92), and Spiro and Jehng (90).

Cognitive flexible hypertexts are intended to engage learners in more meaningful, transfer-oriented, advanced knowledge acquisition. Cognitive Flexible Hypertexts are supported by the Cognitive Flexibility Theory (Spiro et al., 88). This theory is a conceptual model for instruction based upon cognitive learning theory and attempts to avoid oversimplifying instruction, provides multiple representations of content, emphasizes case-based instruction, focuses on context-dependent knowledge, and supports the natural complexity of the content domain in order to foster the development of advanced knowledge, particularly in ill-structured knowledge domains.

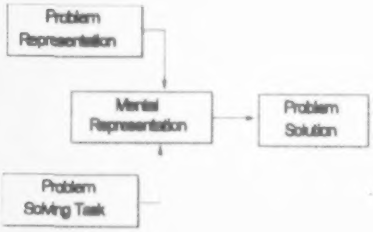
THE COGNITIVE FIT PARADIGM

In the MIS literature, the graphs *versus* tables controversy which went on during the 80s and early 90s was similar to the controversy about the effectiveness of computer-based learning aids. The inconsistency of the results had captured the attention of several researchers since some results proposed that subjects using graphs performed better than subjects using tables, other studies proposed exactly the opposite, while other studies reported no differences. Vessey (91) gathered the results of all those studies and used them as her source of data. Using the cognitive fit paradigm, she proposed that the issue of "fit" has to be taken in consideration in order to make an assessment of subjects' performance.

Vessey (91) developed the notion that complexity in the task environment will be effectively reduced when the problem-solving aids support the task strategies required to perform that task. She termed that notion: *Cognitive Fit*. Her model was based on a general model of problem-solving depicted in Figure 1. The model views problem-solving as an outcome of the relationship between problem representation and the problem-solving task. Processes in her model are represented by the flows and arrows linking pairs of elements in the model. Also, in this model, she uses the mental representation as a problem representation in human working memory.

The Cognitive Fit Paradigm provides a theoretical background to research on information processing theory (Vessey and Galletta, 91). Newell and Simon (72) stated within their Information Processing Theory that human problem-solvers will strive to reduce their efforts while solving a problem, since they are limited information processors. In order to facilitate the problem-solving process that human problem-solvers use in completing the task, the processing effort must be reduced. If the tool is matched to the task, the processing efforts will be reduced. This is precisely the paradigm of Cognitive Fit. Using this paradigm, she proposed that "*problem-solving with cognitive fit results in increased speed and accuracy of performance*."

Figure 1 General Problem-Solving Model (Vessey, 91).



Cognitive Fit is a cost-benefit characteristic that suggests that "*for most effective and efficient problem-solving to occur, the problem representation and any tools or aids employed should all support the strategies (methods or processes) required to perform the task*" (Vessey, 91). This means that the problem representation a problem-solver uses must be considered in the context of the task to be solved. Also, designers should concentrate on determining the characteristics of the tasks that the problem-solvers must address. Once these characteristics have been determined, they should be supported with the appropriate tools. In other words, despite individual preferences, some tasks demand specific tools; If those tools are available, the task's goals will certainly be attained. This does not mean that there is only one way to obtain the task's goals. What it implies is that when cognitive fit exists, it confers advantages in performance.

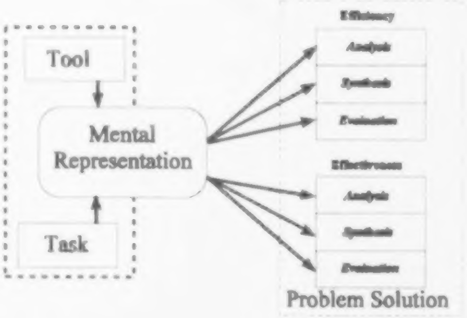
One immediate implication for systems design within the Cognitive Fit Paradigm is that designers can examine the nature of the task to be performed and consequently support the task by providing the problem solver with the problem representation that matches the task (Vessey, 91). The management literature has long investigated the notion of fit (Joyce, Slocum and Von Glinov, 82; Venkatraman and Camillus, 84; Drazin and Van de Ven, 85; Alexander and Randolph, 85; Van de Ven and Drazin, 85; Venkatraman, 89). This investigation is useful since the notion of fit has been broadened. In this ample context, the notion of Cognitive Fit also benefits.

Cognitive Fit, then, can be used as a construct to measure the match of several task-tools pairs in different domains and/or contexts. It will provide enough confidence to researchers, designers, or practitioners to assign a particular tool in order to perform a given task. Unfortunately the literature on Cognitive Fit is limited. This research is offered as a continuation of that work.

THE RESEARCH MODEL

The research model shown in Figure 2 depicts the effects of accessing and using information from linear and nonlinear systems on problem-solving for specific types of problem tasks. This model consists of four components: the user's mental representation, the tool, i.e., information access and display (linear versus nonlinear), the task, and problem-solving performance (efficiency and effectiveness).

Figure 2 Research Model.



In our model, mental representation is the way the problem is represented in human working memory, i.e., the way it is understood. This representation is the output of the characteristics of both the tool used to learn the model and the task. According to Vessey (91), Cognitive Fit Theory views problem-solving as an outcome of the relationship between problem representation and problem-solving task.

The independent variable Tool, captured by means of the treatments, is a special case of the Problem Representation variable used in the cognitive fit paradigm.

A number of studies have been conducted comparing the effectiveness of hypertext and linear text. Some studies involved both the electronic and print media. Others, such as the current study, involve only one of the two media. In some of the studies the goal was to evaluate the effectiveness of hypertext as a search tool, i.e., a tool for locating specific information within a document. Typically in these studies subjects would receive a set of questions, to be answered. There are only a few studies dealing specifically with the question of the educational effectiveness of hypertext as compared to linear text.

A few studies have been conducted in order to compare hypertext-based educational systems to linear text-based ones. After the first ACM (87) conference on Hypertext, held at The University of North Carolina - Chapel Hill, there was an explosion of interest about hypertext in general, and specifically on its educational implications. At Brown University, a group of researchers developed the Hypertext Editing Support System (HESS), the File Retrieval and Editing Support System (FRESS), and Intermedia, three hypermedia systems. These systems were used in a series of empirical studies (Catano, 89; Van Dam, 88; Yankelovich et al., 88).

One of these studies, conducted with FRESS, involved a course on poetry. Results showed that subjects in the experimental group wrote three times as much for both analysis and informational discourse as did subjects in the control group (Catano, 89; Van Dam, 88), even though results were unreliable due to a very small experimental group.

Gordon, et al. (88) conducted a study in order to evaluate the use of hypertext as an intra document text format. Subjects were asked to read two articles, one in linear text, the other in hypertext. Findings indicated that linear text subjects were more successful remembering basic ideas for both types of articles, and showed a better assimilation of the macro-structure contained in the articles labelled as general interest. Subjects indicated a preference for linear text indicating that hypertext required more effort, while reading the material.

In a study to compare the performance of subjects exposed to hypertext material (Khalifa and Ramirez, 92) exposed subjects to hypermedia material in four non consecutive lectures. Results were only conclusive in the between subjects analysis, after the third lecture. Also, each group obtained a higher average mark on the lectures where they used the hypertext material.

Results regarding the benefits of hypertext-based systems have not been conclusive. One reason we can mention is that the learning material was quite simple and the lack of complexity made it equally suitable for linear and hypertext applications. We believe that by including the level of complexity as part of an experimental design, it can be demonstrated that hypertext systems will offer some clear advantages for learning.

An ill-structured domain is determined by its conceptual complexity and its across-case irregularities. In other words, each case or example of knowledge application typically involves multiple conceptual structures (multiple schemas, perspectives, organizational principles, etc.), each of which is individually complex (including both concept and case complexity). The pattern of interaction varies substantially across cases of the same type (each case looks like a 'new' one).

Examples of ill-structured domains include medicine, history, art appreciation, literary interpretation, system's modelling, and systems design. Furthermore, Spiro et al. (92) argue that *all domains which involve the application of knowledge to unconstrained, naturally occurring situations are substantially ill-structured.* They give as an example, the case of engineering, which employs basic principles of Physics (most of them well-structured in the abstract) to "messy" real-world cases. The nature of each case in engineering is so complex and differs so much from other cases that it is difficult to categorize them under any single principle.

Therefore, learning to carry out a procedure, use a concept, understand a system, in this context becomes onerous. Simple examples, memorization and simplification are no longer useful. Knowledge here is intertwined and dependent, has significant context-dependent variations, and requires the ability to respond with flexibility to complex situations.

Problem-solving performance refers to the type of assignment used to elicit different levels of performance. These assignments deal with different levels of the taxonomy of educational objectives (Bloom, 56). Once learning has happened, the understanding of the material may be elicited from the learners at different levels. It may be elicited as verbal information or some other form, depending on the capabilities targeted: intellectual skills, cognitive strategies, verbal information, attitudes, or motor skills.

A group of educational researchers developed what is known as Bloom's Taxonomy of Educational Objectives (Bloom, 56). A taxonomy that (1) provides classification of the goals of our educational system, (2) facilitates the exchange of information about curricula developments and evaluation devices, (3) specifies objectives to facilitate learning experiences and prepare evaluation devices. It consists of explanations of six levels of thinking in the cognitive domain (i.e., Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation). In the forty years of its existence, Bloom's educational learning taxonomy has been widely used in developing instructional and testing material.

The taxonomy consists of three parts: the cognitive, the affective and the psychomotor domains. The cognitive domain, which is the concern of this research, includes those objectives that deal with the recall or recognition of knowledge and the development of intellectual abilities and skills. It is the domain in which most of the research in curriculum development and evaluation has taken place.

Probably the most common educational objective is the acquisition of knowledge or information. In other words, it is desired that as a result of completing an educational unit, students will be changed with respect to the amount and kind of knowledge they possess. Frequently, knowledge is the primary, sometimes almost the only, educational objective in a curriculum. By knowledge, we mean that students can give evidence that they remember, either by recalling or by recognizing, some idea or phenomenon with which they have had experience in the educational process.

Bloom's taxonomy regards knowledge as basic to all other elements it encompasses. Problem-solving and thinking are not carried out in a vacuum. They are based on some kind of knowledge. Knowledge becomes the material of the problem or the yardstick to verify the accuracy and adequacy of the solution.

With respect to the dependent variable in the research framework of cognitive fit, problem-solving performance has been made operational as effectiveness and efficiency of the problem solution for each one of the levels of complexity used to design the tasks (Analysis, Synthesis, and Evaluation). Effectiveness is captured as a percentage of the maximum score for each level of complexity.

Following Vessey's (91) argument that in order to fully account for time and accuracy tradeoffs, both have to be assessed jointly, Efficiency is captured as a ratio of the obtained score, divided by the time spent solving the problems for each level of complexity. In the literature, efficiency is measured as speed, but captured by the time spent solving the task, (Vessey, 91, Vessey and Galleta, 91), which we find inappropriate in this learning situation, mostly because we expect to be able to qualify the use of time while learning and solving problems with the obtained score.

Bloom's taxonomy includes six levels from knowledge to evaluation. We are interested exclusively in the three higher levels of the taxonomy since this research deals with complex and ill-structured material, suited for advanced learning. Since the first three levels deal mainly with the knowledge of the "language" of the domain in question, then knowledge, in Bloom's terms involves remembering either by recall or recognition the ideas, material or phenomena of the domain under study. Advanced learning takes these issues as given. Since subjects have had a previous introduction to the theme, they are familiar with these ideas, material or phenomena. Therefore the knowledge of these ideas is independent of the learning method used by subjects in our research.

A similar argument can be made for comprehension, the next level in Bloom's taxonomy, since comprehension represents the lowest level of understanding, with an emphasis on a grasp of meaning or whether learners know what has been expressed and are able to use the material or idea without further explanations. Again, advanced learners are familiar with the terminology of the domain in question to a point that they are able to follow a discussion in the domain without difficulty.

The next level, application, deals with abstractions of elements in the learning domain, mainly to see whether learners are able to identify them in a concrete situation. At this level, subjects are not asked to do more than identify elements in a particular situation. Advanced learners are expected to do that without major problems.

Since analysis involves the breakdown of ideas into its constituent elements, this is the first level of interest in our model. Here, advanced learners need more than an understanding of the material, they are asked to analyze each element and see whether they can indicate how the material is organized, and detect the relationship of its parts. The learning material will definitely have an impact on how these issues are conveyed to the learner. So starting with analysis, and continuing with synthesis and evaluation, these are the levels of complexity of interest in the present research.

Research Hypotheses

This section presents the hypotheses derived from the research model, in light of the Theory of Cognitive Fit. These hypotheses are organized according to the level of complexity and separated by the variable under study.

H_{1A}: Users learning from the hypertext version of the learning material will perform more effectively on a case study than users learning from the linear version of the same material, when the emphasis of knowledge is on quantitative and qualitative judgments (i.e., level of complexity is Evaluation).

At this level, subjects using the hypertext version are expected to have a deeper understanding of the model and based on that model, make more sound judgments. This means that they will be more accurate in their judgments according to a previously validated instrument.

H_{1B}: Users learning from the hypertext version of the learning material will perform more efficiently on a problem-solving test than users learning from the linear version of the same material, when the emphasis of knowledge is on quantitative and qualitative judgments (i.e., level of complexity is Evaluation).

This hypothesis is similar to H_{1A}. The only difference is the variable of interest. H_{1B} deals with efficiency in the same way that H_{1A} deals with effectiveness. The main difference is that subjects are not only expected to be more accurate, they are also expected to do it faster.

H_{2A}: Users learning from the hypertext version of the learning material will perform more effectively on a case study than users learning from the linear version of the same material, when the emphasis is on inferences made about the learning material (i.e., level of complexity is Synthesis).

Subjects are expected to make inferences about the model in a specific case situation. Since the understanding of the material will be different from those in the control group from those in the experimental, we expect to observe this difference on the way they make inferences in a case study.

H_{2B}: Users learning from the hypertext version of the learning material will perform more efficiently on a problem-solving test than users learning from the linear version of the same material, when the emphasis is on inferences made about the learning material (i.e., level of complexity is Synthesis).

We can present a similar argument between H_{2A} and H_{2B} regarding efficiency versus effectiveness. At this level subjects are also expected to perform faster and more accurately.

H_{3A}: Users learning from the hypertext version of the learning material will perform as effectively on a multiple choice test as users learning from the linear version of the same material, when the emphasis is on breaking the model into its constituent parts (i.e., level of complexity is Analysis).

At this level, advanced learners will be able to grasp this knowledge from both versions of the material, so they are expected to perform equally well. This hypothesis is presented as a way to validate our approach that all the previous levels of the taxonomy are not really meaningful at the advanced level. In other words, the learning material being implemented in hypertext will not make a difference unless subjects using it are requested to have a deeper understanding of the material, and also to use the information for more complex tasks.

H_{3B}: Users learning from the hypertext version of the learning material will perform as efficiently on a problem-solving test as users learning from the linear version of the same material, when the emphasis is on breaking the model into its constituent parts (i.e., level of complexity is Analysis).

Finally, the same argument is made between H_{3A} and H_{3B} where subjects in both modules are expected to perform equally in accuracy and in about the same amount of time.

Basically what these hypotheses say is that the effectiveness and efficiency characterising performance of subjects in the experimental group working on problem-solving increases as the level of complexity does, compared to the control group. These hypotheses are based directly on the Cognitive Fit Theory discussed previously. What it is new here, is that by incorporating the level of complexity in this model, we are looking to settle the differences in the results of the use of hypertext for learning literature, regarding the benefits of using hypertext as a tool for learning.

These hypotheses argue for a reduction of the ambiguity associated with stating instructional objectives and a translation of these objectives into relevant test items. In particular, this research deals with the three highest levels of the cognitive domain: analysis, synthesis and evaluation (Bloom, 56). After forty years of usage, this taxonomy provides a reliable way for designing test material.

RESEARCH METHOD

A full randomized design was used that includes two factors: Hypertext and Linear text. This arrangement gives six possible outcomes, coded **HA,** Hypertext version-Analysis, **HS,** Hypertext version-Synthesis, **HE**, Hypertext version-Evaluation, **LA,** Linear version-Analysis, **LS**, Linear version-Synthesis, and **LE**, Linear version-Evaluation.

A complex and well-supported implementation model was used, the one developed by Lucas, Ginzberg and Schultz (90). It is a rigorous and integrative model of the process of implementation. It combines the two major streams on the research of implementation: process and factor research. The model consists of two stages: the adoption of the system by the manager, and its usage by his or her subordinates. Since each of these two stages is complex in itself, we decided to work exclusively with the manager sub-model (referred to here as the Manager Model).

Lucas, Ginzberg and Schultz (90) developed this structural model of implementation incorporating many of the results of past implementation research studies. It is based on the research traditions of causal modelling, attitude modelling, and innovation process modelling. They used this approach to explain the phenomena of systems implementation with a conceptual model rich in theoretical implications but complex. Its complexity has often discouraged its inclusion in the Information Systems (IS) Curriculum.

The variables included in the model are based on the research findings of previous implementation studies. The logic of the model is that implementation begins with management initiation and acceptance of a given IS and ends with user satisfaction with the system. Factors leading to manager acceptance are *personal* (MANAGER DECISION STYLE, MANAGER DEMOGRAPHICS), *task-related* (MANAGER JOB CHARACTERISTICS), and *system-specific* (MANAGER KNOWLEDGE OF SYSTEM, MANAGER ASSESSMENT OF SYSTEM AND SUPPORT). TOP MANAGEMENT SUPPORT is seen to influence both MANAGER'S BELIEF IN THE SYSTEMS CONCEPT and MANAGER'S INVOLVEMENT with systems development. Beliefs and involvement do not directly lead to ACCEPTANCE; rather stronger belief leads to more involvement. Also, both stronger belief and more involvement lead to more knowledge of the system. All this to say, that some factors depend on other factors which increases the complexity of the model.

The Hypertext Module

The Hypertext module consists of nine screens and ten windows. The first screen is an introduction to the model and the learning objectives are stated as goals. Subjects go through the remaining screens and windows at their leisure. Every time they move from one screen to another (or to a window), a tracer captures the time they access that location and writes this information into a tracing file. Links are filtered through programs that highlight the relevant information concerning the selected factor or influencing dimension. It really does not matter the way they traverse all the information, the tracer captures this "personalized" trip and keeps the information for future analysis.

The Linear text Module

The linear text module is a copy of the hypertext module without hyper-links. The only links are linear links that allow users to move from one screen to the next, either forwards or backwards. This way we are sure that the information presented to both groups is the same. What is different is the way to access the information.

The Test and the Cases

The testing material consists of three parts: A multiple choice test dealing with analysis of the information presented on the learning module. A short case-study, in which the subjects are expected to make some inferences based on the learning material. A longer case-study dealing with the implementation of an information system, subjects are expected to make judgments regarding the success (failure) of its implementation, based on the learning material. These testing materials were validated through a pilot study (Ramirez, 1997).

Subjects were one hundred and three undergraduate students (49.51% females, 50.49% males) majoring in MIS in their last year of a Bachelor of Commerce program, enrolled in an Information Systems Analysis course. At this level, the learning material is more relevant and motivated participation. Participation was voluntary. A couple of incentives were offered. Five extra points, participation points, in the course mark were offered to increase participation, and cash prizes to top performers in each group were offered to motivate performance.

Experimental Procedures

There was an information session for all the students in the targeted population. In this session, subjects were invited to participate in and informed about the study.

Subjects had a hands-on training session. Even though it was almost certain that subjects have had a previous exposure to similar tools: mice, icons, windows, links, etc., their knowledge was not taken for granted.

The first module, training, consists of six screens and nine windows. The purpose of this module is to allow subjects to move successfully around four locations (HomePage, Point A, Point B, and Point C) while reviewing information.

When subjects were familiar with the system's features, they were exposed to the learning material. Students were allowed to spend as much time as needed learning its content. The learning module, contains the information of Lucas, Ginzberg and Schultz' (90) Implementation Model. There were two versions of this material, a hypertext-based, and a linear version.

When subjects finished working with their version (hypertext, linear text) of the learning material, they were advised that they had finished with it. They had two options in the form of labelled links (buttons: REVIEW MODULE, and WRITE THE TEST). When they chose to write the test, they left the learning module and moved on to the test and the cases.

RESULTS

Table 1 presents the results of the tests of Between-Subjects Effects for the dependent variables Effectiveness and Efficiency in Evaluation, Synthesis and Analysis. In order to compensate for the deficiencies of running simultaneous tests, the univariate analyses were adjusted using the Holm Simultaneous Testing Procedure (Holm, 79). This procedure (Holm, 79) is a refinement of the Bonferroni adjustment for conducting a family of tests. It is applicable when the simultaneous tests is a particular set of pair-wise comparisons, contrasts, or linear combinations that is specified by researchers in advance of the data analysis.

The Holm procedure carries out the simultaneous testing by obtaining the P-value for each test but then modifies the level against which the P-value is compared in order to improve the power of the test (Holm, 79). Consequently, the Holm procedure may find significant effects when the Bonferroni procedure does not, for the same significance level. This procedure, slightly more complex computationally, allows adjustments for one side tests, since a P-value must be found for each test.

The results on effectiveness and efficiency in evaluation by method indicated significant effects (F=5.984; p=0.008 and F=5.477, p=0.010). These findings support our claim that the hypertext resulted in superior problem-solving than the linear system. Results in synthesis and analysis do not indicate significant effects.

Learning time shows significant effects with effectiveness in evaluation (F=7.178, p=0.009) and analysis (F=17.818, p 0.0009) as well as with efficiency in analysis (F=12.482, p=0.001).

These results suggest that subjects' performance is more effective and efficient when using a hypertext-based learning aid at a higher level of complexity than at lower levels. This can be interpreted as, hypertext-based learning aids significantly improve problem-solving performance of subjects at higher levels of task complexity, i.e., there exists cognitive fit between the level of complexity and hypertext-based learning aids.

TABLE 1
ANALYSIS OF VARIANCE RESULTS FOR LEARNING TIME AND METHOD

Level	Variable	Learning Time	Method
Evaluation	Effectiveness	F(1, 100)=7.178, p=0.009	F(1, 100)=5.984, p=0.008
	Efficiency	F(1, 100)=3.754, p=0.056	F(1, 100)=5.477, p=0.010
Synthesis	Effectiveness	F(1, 100)=0.014, p=0.907	F(1, 100)=0.339, p=0.281
	Efficiency	F(1, 100)=0.136, p=0.713	F(1, 100)=0.293, p=0.295
Analysis	Effectiveness	F(1, 100)=17.818, p=0.000	F(1, 100)=0.940, p=0.335
	Efficiency	F(1, 100)=12.482, p=0.001	F(1, 100)=1.066, p=0.304

This implies that educators or trainers can benefit from hypertext by using this kind of learning aid to address complex and ill-structured learning materials. To insure that resources are better allocated and not wasted, educators and trainers could insist that learning material that is complex and ill-structured may be implemented in hypertext. Also, they may insist that only that kind of material be implemented in hypertext, since there is a direct improvement on performance.

A major contribution of this research is the methodology used to assess the cognitive fit of more complex pairs of tools-tasks than those reported previously in the literature. The research design and the experimental materials were based on the "match" between the technology and the task, under the cognitive fit paradigm. It is within this theoretical framework that the effects of hypertext and level of complexity were analysed and hypothesised.

The material was designed within the philosophy of constructivism. One of the assumptions that works well in this model is that meaning varies with how the individual creates it from his or her experiences. Since no subjects in the hypertext module chose to traverse the information sequentially, each one of them had a different learning experience. Each of them created her or his own construction of the model. This did not mean that some were right and others wrong; the model learned is the same, their understanding of it was different.

An important feature of the hypertext learning material used is that it allowed learners to selectively visit each dimension and the factors/dimensions that have a direct/indirect influence on them. This option provided a way to understand the patterns of association (by means of the highlighted information) which revealed the conceptual information of the model. We can say that just by exploring, in a constructivist manner, subjects in the hypertext module were actually learning.

CONCLUSION

The major purpose of this study was to make an assessment regarding the contribution of hypertext-based learning aids in the acquisition of advanced knowledge. A hypertext-based learning aid and a linear text learning aid were developed and tested in order to conduct this research. Subjects were randomly assigned to the treatments, i.e., hypertext and linear text. Subjects in the hypertext group were designated as the experimental group and those in the linear text group were designated as the control group.

Three sets of two hypotheses were formulated and tested. The first set is concerned with effectiveness and efficiency of performance at the level of Analysis in learning. The second is concerned with effectiveness and efficiency of performance at the level of Synthesis in learning.

Finally, the third is concerned with effectiveness and efficiency of performance at the level of Evaluation in learning. In all these cases, the hypotheses were tested at the =0.05 level of significance and adjusted for multiple comparisons using Holm's Multiple Comparison Procedure (Holm, 79). We found that at the highest level of complexity tested, Evaluation, the tool had a significant effect on effectiveness and efficiency of subjects' performance.

Limitations

One of the major limitations of this research is the method chosen for this study. We used a laboratory experiment, emphasising internal validity, but weak external validity. Despite considerable efforts to minimize the limitation, external validity suffers from the artificiality of a laboratory setting and data collection procedures. Thus, findings are less likely to be generalised across settings (Cook and Campbell, 79).

On one hand, we had an artificial setting, on the other, we used a complex and well-supported implementation model. The setting was artificial mainly because subjects worked in a different environment than they regularly use, i.e., a classroom. Otherwise, we can claim that the learning environment is similar to any other computer-based learning material. The content, though, is an actual implementation model. This model was implemented directly from the book it was reported without any simplification.

Subjects were undergraduate students, majoring in MIS, enrolled in a System Analysis Course. For them, the learning material is similar to the one included in their syllabus for the course, even though this particular model is not included. Therefore, it may still be appropriate to generalise the findings to similar populations, i.e., MIS majoring undergraduate students.

Differences in performance were measured by having subjects work on the same problem-solving tasks. The experiment took place in a two-week period. It is possible that subjects commented among themselves the kind of problem-solving tasks used. But, since they were unaware of exactly what options were correct, it would not help them much to know in advance the kind of tasks they would be evaluated.

One important limitation is the fact that complex models are difficult to implement. The information necessary to show differences that exist, mainly in perception, can rapidly escalate. Sometimes it may not be feasible to attempt its implementation; Other times, it may be irrelevant to do so. One of the most important learning experiences, derived from this research, is the acknowledgement that finding a workable balance between feasibility and relevancy should be the main goal when designing instructional material for hypertext.

Directions for Future Research

Hypertext is not the solution for every problem in learning. There are many aspects of learning where hypertext does not have a meaningful contribution. That was clearly shown in this research. Still, we need some criteria to determine which aspects of the learning process are better served with hypertext. It seems that those areas where information is not linear, or where by imposing linearity the information is not oversimplified, are excellent choices.

The design of the new generation of hypertext learning aids should foster learning by discovery in a constructivist way, bring some kind of structure to ill-structured material, and allow material to be revisited at different times, in different contexts. In cases where the amount of information is overwhelming, that information should be broken into modules and meaningful links should allow the traversal of each of them from different parts of the system. When necessary, the system should provide "guided tours" to the information. One aspect to investigate on these guided tours, is whether they promote motivation to learn.

This study can be extended in at least two ways. First, it may be worth investigating the application of hypertext-based learning aids to other tasks dealing with knowledge acquisition. Second, a similar assessment of Cognitive Fit can be performed using other tools (multimedia, World Wide Web, Internet, Intranet, etc.) for similar tasks (learning). We can use Leidner and Jarvenpaa's (95) theoretical information technology fit with other theories of learning, to match the task-tool pairs.

With the advance in IT applications, we expect to find more applications of these technologies in schools, universities, and organizations. If that is the case, it will be possible to used those tools instead of having to create them specially for research studies, increasing the external validity of research findings.

In conclusion, this research is the beginning of what is anticipated to be a rich stream of research based upon measuring the effects of emerging technologies on training and learning. It seems that this kind of research in not only needed, it is also urgent. Emerging technologies are having more and more an impact on the way we educate and train in particular, and do businesses in general.

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TEACHING VIA THE INTERNET – A CASE STUDY

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This case study reports the results of a course offered from Sydney, Australia to students in Singapore with the traditional distance materials being supplemented by Internet-based resources - a web site containing the study guide, a discussion database and e-mail. It outlines the procedures followed and the difficulties encountered. The students completed a survey covering issues such as usefulness, difficulty, enjoyment and acceptability. These survey results are discussed along with views of the facilitator. The paper concludes with a list of the lessons learnt.

INTRODUCTION

This paper outlines the development, preparation and delivery of a subject in an MBA-type programme, using Internet resources.

A Master of Business Technology (MBT) programme is offered by the University of New South Wales to students in several different delivery modes -face-to-face on campus or in-house, and via distance. There is a variation on distance for students in Singapore - a three-day workshop, run by the facilitator is included. All students are provided with a comprehensive set of materials for each subject including a study guide, selected readings and in some cases, a textbook. The subjects consist of 12 units, each of which have a number of exercises to illustrate and reinforce the learning material. The distance students are encouraged to contact other students by telephone, fax or e-mail, to discuss the exercises and the course in general and to contact the subject facilitator as necessary to seek clarification or advice. Assignments are forwarded (normally by post) to the facilitator for assessment. In practice, discussion between students is at best infrequent and often non-existent and it is very rare for students to contact the facilitator. Against this, the students studying in the face-to-face modes highly value the weekly discussion sessions, drawing information from other students, group discussions and the facilitator.

The University is currently promoting a number of initiatives aimed at using Information Technology to enhance education delivery. In the first semester of 1998, the subject *Information Systems Management* was offered to MBT students in Singapore using a range of Internet resources. Under a range of headings, this paper discusses the presentation of the subject, the advantages of this form of delivery as seen by the students and the facilitator and outlines the difficulties and pitfalls encountered.

The Students

15 students did the course in Singapore; 12 completed a survey aimed at assessing the presentation of the course via the Internet. The survey attempted to assess the feelings of the students in the areas of

- usefulness of the web for teaching
- degree of difficulty experienced
- enjoyment
- acceptability as a alternative to the classroom
- participation in discussion

Data was also gathered relating to sex, age, computer skills, and Internet knowledge and use. The students were predominantly male (9 out of 12) and aged in the 26 – 40 bracket. Most rated their computer literacy skills as "some" to "reasonable" (points 2 and 3 on a 5 point scale) and their Internet knowledge likewise. Most indicated they used the Internet (outside the course) either "occasionally (at least monthly)" or "frequently (at least weekly)". Internet use outside the course varied widely, with those who used it most likely to do so for e-mail and entertainment.

The Web-based Course

The course notes – in order to improve portability, the study guide, including the exercises in each unit, was converted to HTML and made available to the students on a web site. This conversion process took approximately 3 – 4 weeks of full time work and involved the subject author's research assistant in learning the tools involved, experimenting with the importation of text and graphics, formatting and design of the pages and setting movement between various sections of the unit and the subject. A decision was made to keep graphics to a minimum to improve download time. Reformatting the text and graphics to enhance its screen appearance was a high priority and a time consuming task. Only minor modifications were made to the text itself – in most cases, the hardcopy text was appropriate for the web site. This does indicate though that at least a critical review of the text was required. The modifications made mean that there are now two versions that need to be kept up-to-date. *The discussion database* – Lotus Notes was used to establish a discussion database, which the students could access via an Internet browser. It was intended that this would be used for distribution of information about the course by the facilitator and for each student to post responses to the exercises. They (and the facilitator) would be able to view each other's responses and comment on them. To encourage use of the database, a small percentage of the overall assessment was allocated to database contributions. The following difficulties were encountered in the establishment and use of this form of "virtual classroom".

- A range of administrative problems in setting up the database, including setting up a list of users and their passwords, determining on which server the database would sit, setting access levels, and adding late enrolling students to the database. The database was being provided, on an informal basis, by one faculty as a "favour" to another – this required considerable effort on the part of the facilitator in working outside normal administrative arrangements.

- As might be expected, students were somewhat nervous about submitting their written comments for all to see – this was exacerbated to some extent by their inability to delete their postings or to change them once they had been submitted to the database. Deletion required the intervention of the facilitator, which by necessity had to take place at a later time.

- Several students were unfamiliar with both World Wide Web browser access and, to some extent, were less "computer literate" than their peers.

E-mail – all students eventually had access to e-mail (though there were some difficulties in this access) and the facilitator used this extensively to communicate with individual students and to send messages to the group as a whole. Problems with e-mail included

- No e-mail addresses for some students at the beginning of the course

- Incorrect addresses, partly due to being re-keyed a number of times in the administration of the programme

- The inability of some students to access their e-mail at all times (sometimes for quite long periods)

- Several changes to e-mail addresses during the course

- Unavailability of servers from time to time, frequently meant messages "bounced"

Assignments – the students were given the option of submitting assignments directly to the facilitator by e-mail. The facilitator reviewed these on screen and provided comments by e-mail. All students agreed that submission of assignments electronically was the best method and found this a significant improvement over the postal submission and return of assignments, primarily due to the quicker turn around. Due to the small number of students the facilitator had no difficulty in reading marking the assignments on-screen.

Course Evaluation

Usefulness of the web for teaching – Most students agreed that the discussion database was very useful to them in undertaking the course and they appreciated the opportunity to communicate with fellow students in this way. As might be expected, the availability of the study guide on the web was of less importance (as they also had the hardcopy). From the point of view of the facilitator, there is little doubt the workload increased, and increased considerably. This was due to his involvement in the discussion database and the need for regular e-mail correspondence with the students, either individually or as a group. Against this, the approach followed does allow some degree of control, in that the facilitator can allocate time to the task at his convenience. It should be noted too, that a part of the usefulness may well come from the increased facilitator involvement.

Degree of difficulty experienced – All students considered the discussion database easy to use and few reported any problems in logging-on, using e-mail or using the web version of the study guide. This may reflect the relatively sophisticated electronic infrastructure in place in Singapore, the computer literacy skills and Internet experience the students brought into the course and the effort put into the set-up of the course by the facilitator.

Enjoyment – There is little doubt that as a group the students enjoyed the use of the technology in the course. All students agreed that it was a good idea although only 4 wanted it extended to other subjects in the programme – most (7) were neutral. This may be related to the subject being an Information Systems subject, it may mean that they feel there is room for improvement.

Acceptability as an alternative to the classroom – Almost all students felt that they could not agree with the statement "the discussion database is a good substitute for the classroom", although they found it useful, easy to use and enjoyable. These findings are not necessarily contradictory: while it might be an improvement on the normal distance courses offered, the technology still has some way to go to replicate the classroom experience. The provision of higher education in Singapore is one of the most competitive markets in the world and many courses do provide some classroom-based instruction or workshop as part of their distance offerings. Indeed this survey was conducted during a weekend workshop, which may have coloured the findings to some degree.

Participation in discussion – The data collected in the survey indicates that most students believed that they checked and used the discussion database at least reasonably frequently. This is not reflected in their contributions to the discussion. A very small group of students (2 or 3) contributed about 75% of the discussion submissions. This is not to say that these contributions were not read by the other students or that they did not find them useful and illuminating. Perhaps this reflects the position in the classroom. It is also noticeable that the contributions to the database increased after the workshop when all the students had met one another and the facilitator.

Lessons Learnt

The following is a list of some of the lessons learnt, along with some of the methods used to overcome the pitfalls in this and subsequent courses:

- Ensure all administrative arrangements, including technical support, are in place well before the course starts. Establish what procedures will need to be followed to add students who enrol late.

- Expect problems in establishing mailing and discussion database user lists – one way of improving this is to ask students to e-mail the facilitator, providing an e-mail address, password and a user-name.

- Prepare a comprehensive and easy-to-read set of instructions for use in relation to the web sites (record all problems that occur and consider them for inclusion in the instructions next time).

- Ideally face-to-face student introductions should take place at the start of the course. Failing this, Web-based introductions, contact details and advice of work experience are a good way of starting submissions to the database.

- Regularly review the discussion database and add comments – draw on the experience of some of the students and ask them for specific comments on issues about which they are likely to have some knowledge.

- Provide past examination papers, and "best" assignments on the discussion database for all to see.

- Accept electronic assignments wherever possible.

- Don't expect, and don't encourage the students to expect, too much from the technology. It is still in its infancy.

COLLABORATIVE LEARNING ENVIRONMENTS FOR MANAGEMENT EDUCATION

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Confronted with the pressure of a rapidly changing environment, organizations demand new skills and capabilities of future managers. These demands on one hand, and the findings of Learning-theory on the other hand, necessitate a corresponding change in education of tomorrows managers. Future management education needs a balance between the imparting of knowledge to the learner, and the learner's own construction of it. In the following, we describe how the foundation for such a future Management Education can be laid, by what we call Collaborative Learning Environments. Therefore we describe the framework, implementation and experiences in team-oriented learning and knowledge creation via Collaborative Learning Environments, based on our research program Genius (Groupware enabled Learning Environment for Education in Management at the University of St. Gallen). Starting with an overview of the Genius Projects we use the course "Technology-enabled learning and knowledge creation" as an example of how the Genius Framework is put into effect on the CEMS Genius Platform.

INTRODUCTION AND MOTIVATION

New Skills and Capabilities Required for Future Managers

Confronted with the pressure of a rapidly changing environment, organizations demand new skills and capabilities for future managers. Research has shown that managers of the future will require a more intensive mix of skills and competencies than their predecessors[1]. According to *Hiltrop*, future managers have to show mastery of four key competencies. Managers will need to engage in continuous learning and self-development. Their challenge is to keep pace with the change and to adapt to the evolving needs of the organization. Future managers will increasingly find themselves, either directly or indirectly, interacting with other functions, cultures and professionals. Therefore they have to be Networkers, i. e. every manager will need to be able to collaborate effectively with a wide diversity of experts and multi-disciplinary groups of people[2]. Future careers will not be well specified and secure[3]. Thus future managers must be self-reliant and take responsibility for their careers and income. In addition to other skills, they will need the ability to live with high levels of uncertainty, and bounce back quickly from failure and disappointment. In other words, the future manager has to become resilient. That is to say he/she has to be highly initiative, willing to take risks, and persistent even in the face of adversity[4].

Need for a Paradigm Shift in Management Education

A widespread weakness of Management Education today is, that a large amount of knowledge is imparted additionally, i.e., without any attempt being made to interlink them by means of questions arising from the reality of daily business practice. Such knowledge remains in many cases knowledge which has not been truly understood, because it has been merely learnt by rote and therefore cannot be consciously disposed of, or summoned up to help its possessor to deal with concrete situations. A suggestion frequently made is that the quantity of material to be learnt should be reduced to a minimum, and that the lesson-time so gained may be devoted to the cultivation of such qualities as problem-solving, decision-making, creativity, etc. Such an approach is justified with the claim that a high percentage of the knowledge acquired will in any case become obsolete, and it is therefore useless to accumulate much of it. From the vantage-point of Cognitive Psychology, such statements must be judged erroneous. The disposability of knowledge remains the chief prerequisite for all learning. What is decisive, however, is that knowledge should be worked for, that is to say, the thought-processes associated with knowledge-acquisition should be made visible in realistic situations[5]. In this context, there is no need to place all information at the learner's disposal. What is necessary is formative, "opening-up" knowledge which enables the learner to apply knowledge creatively, and which gives her/him the opportunity to create new knowledge[6].

An other widespread weakness of Management Education today lies in its too one-sided alignment to concrete learning-results (Product-orientated Learning), and in its neglect of Process-orientated Learning. Learning, and above all the transfer of what has been learnt to other situations, could be much more successful if Process-orientated Learning were introduced into Management Education. The term "Process-orientated Learning" means making learning- and thought-processes visible, so that students systematically acquire learning-strategies, i.e., the procedures and courses to be adopted when learning, or, respectively, thinking-strategies and -processes. As learning- and thinking-strategies are tied to one subject, however, they cannot be acquired in a universally applicable form by the study of any other[7]. For this reason, lessons must be planned in such a way that learners not only succeed in attaining the learning-objective, but realize how they did so. What is crucial thereby is that metacognition, i.e., the learners' knowledge of their own learning and their ability to guide it, is developed. Good metacognition leads to better learning-performance and reinforces one's own self-concept (the ability to exploit one's own powers and recognize one's limitations)[8].

Genius – Collaborative Learning Environments for Advanced Management Education

The findings of Learning-theory on the one hand, and the demands made on future Management Education on the other, imply the need for a balance between the imparting of knowledge to the learner, and the learner's own construction of it. These changing environments necessitate a corresponding change in education of tomorrows managers by what we call *Collaborative Learning Environments*. For the purpose of this paper *Collaborative Learning Environments* may be defined as

> learning communities combining the potentialities of modern Information and Communication Technologies (ICT) with advanced methodological-didactic concepts in order to improve learning and knowledge creation.

In the following, we describe how the foundations for such a future Management Education can be laid. Therefore we discuss the experiences of the Genius Projects at the university of St. Gallen. Starting with an overview of the Genius Projects we use the course "Technology-enabled learning and knowledge creation" as an example of how the *Genius* Framework is put into effect on the *CEMS Genius* Platform.

Overview Genius Projects

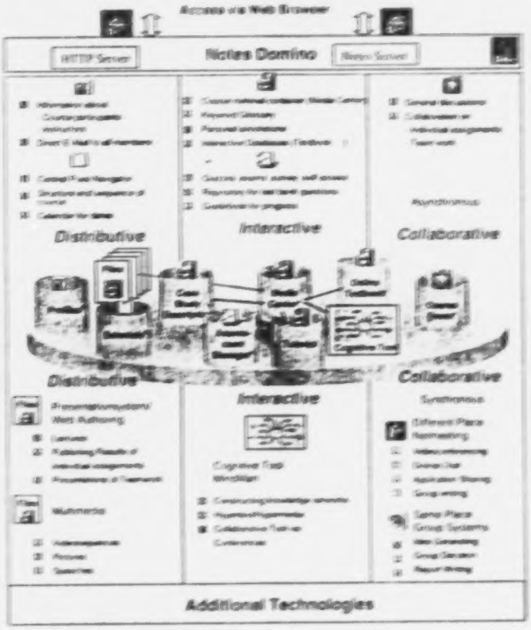
Genius has hitherto been put into effect in three research projects, each with its own emphasis. In the following, a synopsis of these projects will be briefly presented, before, finally, the way it is put into effect is illustrated with the example of Project *CEMS Genius*. *MBE Genius* is a learning environment employed in the Executive Study Program "Master of Business Engineering" (MBE). The objective of this program is the education of change managers. The learning network is made up of a team of lecturers and MBE course-members, most of whom are graduates in Business administration from medium-sized and large companies. The course takes places in several blocks, most of them requiring the students physical presence. During and between the course-blocks, *MBE Genius* functions as an information and communication platform, by means of which the participants can prepare for the next group of themes. *MBL Genius* is the learning environment for the Executive Study Program "Master of European and International Business Law". In this case, the learning network comprises a team of lecturers made up of specialists from all over the world, and MBL course-members, who are often lawyers with private practices. As temporal and geographical independence are of high importance to such people. The question of the allocation of learning-scenarios is one of great consequence. MBL course-members must, for example, work on complex cases and give expert opinions. For this purpose, course-members have a "library" at their disposal, filled with legal texts, decrees, regulations and other legal documents, which is constantly updated. The learning environment of *CEMS Genius* forms a inter-university network. CEMS stands for "Community of European Management Schools". To this network belong some of the most reputable European Universities, and, as corporate partners, some of the most important European corporations. Academics can work together through the medium of Groupware-based learning-environment *CEMS Genius* to offer classes, lectures, etc., to cooperate in remote teams, and to set international teams of students to work upon case-studies independently of time and place. During such courses, students have the opportunity to improve their media and methodological skills in working in dispersed teams – mode of work they will have to accustom themselves to in their future professions. Besides this, prominence is given to learning-processes that introduce the various ways of working of different nations in Europe. CEMS Corporate Partners can more easily be drawn in by means of *CEMS Genius* in order to deliver projects or cases, and to be able to function as "consultative observers".

***CEMS Genius* – An Inter-University Learning Network.** This virtual online course was conducted in the summer term of 1998 in cooperation with the universities of Bocconi (Italy), Cologne (Germany) and Vienna (Austria). 18 students from St. Gallen, 13 of them members of the CEMS Study Program, and 5 MBA students from Universities of Minnesota, USA. 4 students from Bocconi, 6 from Cologne and 5 from Vienna also participated. Based on the *Genius* Framework, we will now outline the learning infrastructure used within the framework of this course to put the technological approach into effect, and the learning strategies to do the same for the didactic approach.

Learning Infrastructure. The infrastructural basis consists of a Domino 4.6 Web Server which apart from Internet access to the underlying Lotus Notes databases, also allows a representation of native WWW formats (HTML, JPEG, Java, etc.).

The Lotus standard software LearningSpace, forms the nucleus of the *CEMS Genius* platform. It was adapted and supplemented with our own Lotus Notes applications as well as with the integration of complementary technologies. Apart from the integration of selected distributive and interactive tools, the extensions concern above all the field of collaborative tools. As the Domino Server in the 4.6 version available permits only the support of asynchronous communications, synchronous communication takes place over Microsoft's software Netmeeting. For assistance with group-decisions, one can additionally fall back upon the meeting support software GroupSystems. Figure 1 gives an overview of the *CEMS Genius* learning infrastructure.

FIGURE 1
CEMS GENIUS LEARNING INFRASTRUCTURE



293

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Distributive Learning Technologies. Within the field of distributive learning-technologies, apart from supplementary tools used to set up Web Presentation and Multimedia Sequences, one can differentiate principally between the profile database and the database for the description of the case studies. The schedule database serves as central navigator. With its aid, the learner can obtain an overview of the course-structure. To this end, the learner can form an opinion on course modules, activities and teaching-personalities. Calendar-functions provide additional orientation. The profiles database collects information on the professional background and personal interests of both the course-members and teaching-personnel. Course-members can thus gain an impression of their fellow-participants, the lecturers, and the guest-speakers. Direct communication via e-mail is also possible. The case-study database contains the introductory information necessary for work on case-studies. Besides basic facts and complementary background material, it includes the team-assignment.

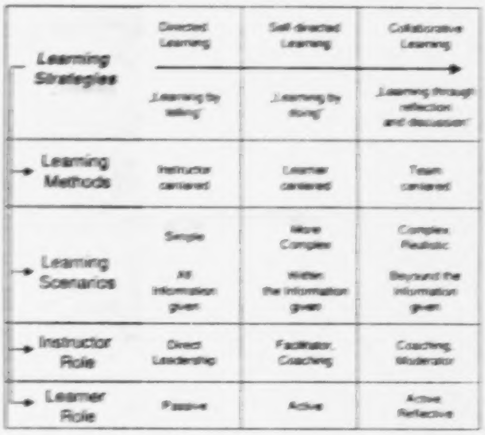
Interactive Learning Technologies. The media center database contains course-materials, lectures, presentations, articles, etc. which may include multimedia data-formats of any description. Apart from this, indications to external sources of information such as WWW links, or links to other Notes databases, can be laid down. As a central repository, it thus points the way to all necessary information and documents. The provision of course-materials such as presentations prepared by guest-speakers or key concepts facilitates the course-members search. As a thematically overlapping script, the Online Textbook is prepared in an electronic version as well as in paper form. This allows of the inclusion of search functions, the integration of hypertext- or media-elements, and the opportunity to record personal notes one has made. Complementary to this, the Tutorial database contains thematically structured task-settings as exercises on and reinforcement of what has been learnt. MindMan is a cognitive tool for graphic visualization and the production of Mind Maps. With the aid of this software, students can work out and structure complex contexts. The assessment manager database is an instrument intended specially for lecturers' development, evaluation or registration of tests. Students have no access to it. The tests can be given to them as quizzes, for self-assessment, or as a final examination.

Collaborative Learning Technologies. Collaborative Learning Technologies offer tools for synchronous and asynchronous communication. The database Course Room represents the asynchronous component. General themes can be discussed there, assignments worked on, information asynchronically shared, and ideas developed. At the same time, one can make contributions public, for oneself or one's team only, or for the lecturers eyes only. For synchronous communication the students have at their disposal on the one hand: Microsoft's Software Netmeeting, for Real Time Chat linked to Videoconferencing, Screen and Application Sharing and group-writing via whiteboards. On the other hand, students can use the Software GroupSystems for problem-solving, which supports the generation of ideas in particular as well as the evaluation of those already formulated.

Learning Strategies

"Learning Strategies" is a term for the general method of procedure for the achievement of learning-objectives. They are made up of learning-methods and learning-situations, as well as the roles of teacher and learner. During the course, the learning-strategies Directed, Self-directed and Collaborative Learning are employed to impart knowledge.

FIGURE 2
LEARNING STRATEGIES



Learning Strategies	Directed Learning	Self-directed Learning	Collaborative Learning
	„Learning by telling"	„Learning by doing"	„Learning through reflection and discussion"
Learning Methods	Instructor centered	Learner centered	Team centered
Learning Scenarios	Simple All information given	More Complex Within the information given	Complex Realistic Beyond the information given
Instructor Role	Direct Leadership	Facilitator, Coaching	Coaching, Moderator
Learner Role	Passive	Active	Active Reflective

Directed Learning. On the grounds of the authors' expressed opinion that knowledge comes into being in the last resort as the individual's own creation, instructor-centered methods are used very sparingly and mainly for the introduction of new thematic complexes. Course-members can help themselves in this respect by taking advantage of the introduction database to case studies as mentioned above, and the presentations prepared by both lecturers and guest-speakers from companies.

Self-Directed Learning. This is very chiefly for the acquisition of the software skills necessary for the course. For this purpose, tutorials contain directions for setting tasks, introducing the participant step by step to different modules. Introductory and monitoring questions make the connection to the material previously dealt with in the Online Textbook. Depending upon the student's stage of progress, she/he can decide what material to repeat and reinforce if necessary. Various sorting functions help the student when working on the theme-complex. For the support of self-directed learning, the learner's attention is also dawn to sources of further information, individual tasks are assigned for the working-out of some detailed theme-complexes. The self-directed learning approach receives particularly strong support from the so-called Self-assessments. These contain questions tailored to various knowledge-fields of the course, which help students to judge of their own progress. For this reason, students can look up the answers to their questions in the system.

Collaborative Learning. Besides Directed and Self-Directed Learning, the emphasis in CEMS Genius is above all on Collaborative Learning. This strategy is used intensively both when students are physically present at classes and for distance learning on case-studies. In the frame of real-presence learning, after a brief introduction students are given short team-assignments by the lecturer, which they are expected to deal with successfully within three quarters of an hour. To prepare their solutions, students have at their disposal the Groupware laboratory of the Institute, which they can use to conduct research on the internet, to make group-decisions (GroupSystems), and to prepare presentations (Powerpoint, Freelance). Of great importance to success in learning is the already mentioned critical reflection within the group. For this purpose, students must present their solution to the whole class and be prepared to defend it in a discussion. The collaborative Learning strategy undergoes further development in the field of the case-studies carried out. They serve to foster the ability to act and make decisions on the part of the course-participants. They are therefore made up of the two elements collaboration and competition. On the one hand, supranational teams are formed (one such may contain students from cologne, Vienna, Bocconi and St. Gallen), each of which seeks to find a common solution, whereas on the other hand the teams compete with each other to achieve the best result. The individual group-tasks are not only evaluated but also discussed at a meeting on the groups' experiences while accomplishing their tasks. Apart from this, the participants with voting-powers can award each other marks for the quality of the final presentation in the Course Room of CEMS Genius. In this way, the course-members are induced to reflect upon their own contribution and performance, thus reinforcing their metacognition of the learning process.

CONCLUSION AND FUTURE RESEARCH

In the interplay with the learning-material, it is no longer teachers but the learners upon whom attention is focused. This implies the need for self-directed learning proceeding from a whole-hearted, not step-by-step, approach to problems, a stronger emphasis on process-oriented instead of product-oriented teaching, and work in teams. It also appears to be essential to success that the teacher manages to create a good learning-climate that allows the class to become a learning-community. This is characterized by group-dialogues, work in groups and as individuals, with the aim of constructing knowledge, not merely receiving it, as this encourages the learners to understand for themselves, not just learn by hearsay. This kind of teaching makes former instructors into learning-advisors. What is more, this approach provides good opportunities for practice in teamwork, which is becoming of ever greater significance in business practice.

If based on a corresponding didactic design, modern information- and communication-technology can be of decisive help here. But it is just in this respect that there is in the authors' opinion, a great deal of lost ground to be recovered for future-oriented Management Education. For example, before the beginning of the first case-study, the teams were advised of the great advantage of using synchronous communications technology to solve it; it subsequently turned out that only three out of six teams had done so. One may add that even the teams which had made intensive use of synchronous communication-forms had used asynchronous media, such as the Discussion Forum, much more frequently. The observation was made that teams with a high degree of interaction produced more comprehensive and creative approaches to solutions in their work on cases.

To sum up: good-cognitive teaching produces good learning results and is well received by learners, but is extraordinarily demanding, and time- and energy-consuming in its preparation. This entails the danger that teachers who do not receive enough guidance on and demonstrations of this form of teaching may remain sceptical towards it. In the authors' opinion, this would be fatal to the prospects of future Management Education of a high standard. For that reason besides the support of learners, a similar support of teachers seems to us essential to the success of cognitive teaching. The results of these reflections will therefore be integrated into a further development of Genius Framework.

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